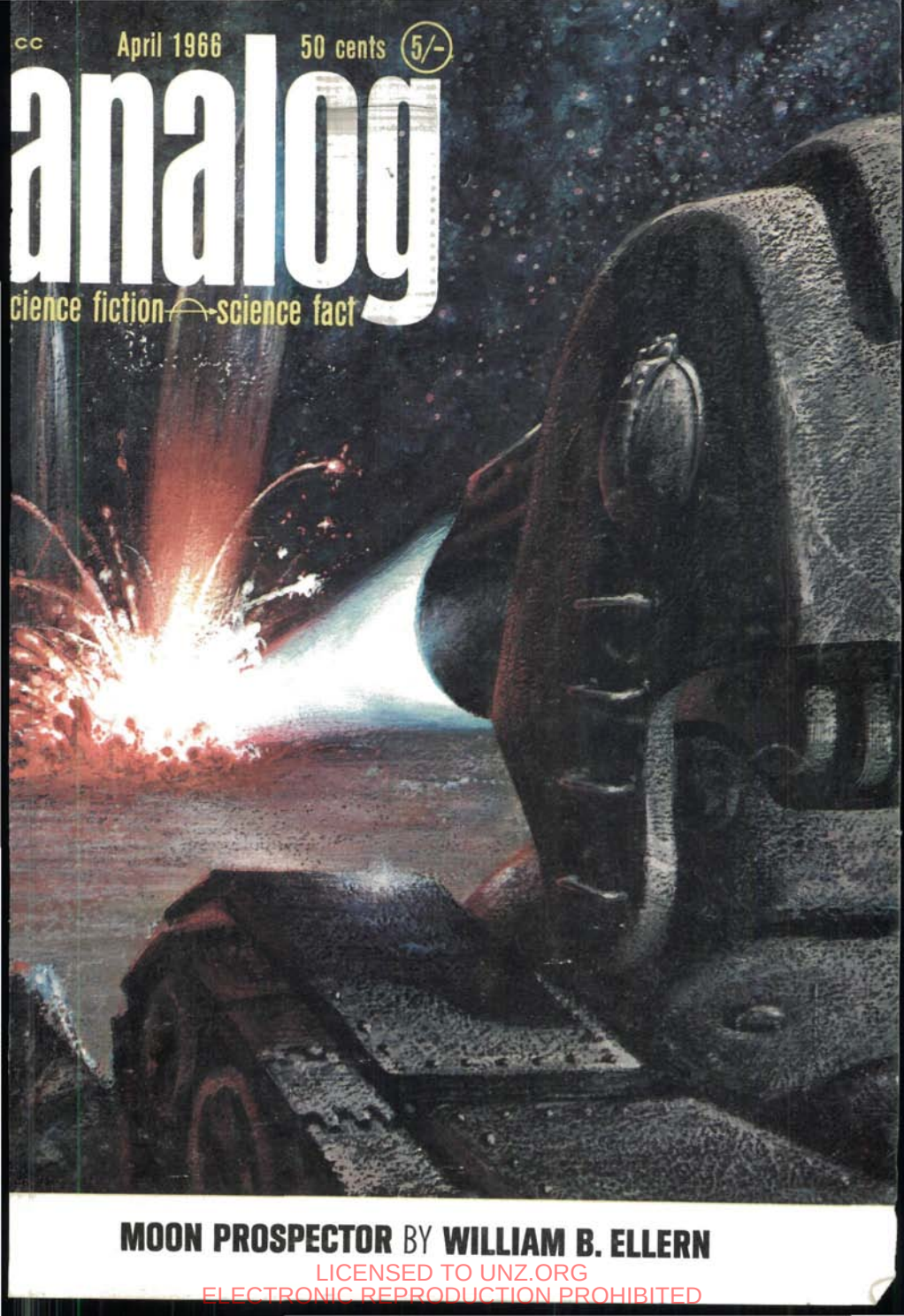


LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

IT'S YOUR MOVE, BUSINESS

Business needs every kind of man. But for strategy moves, it counts more and more on the college man.

That is because higher education gives executives the mentality and skill, the capability and specialized knowledge so necessary to shoulder the management burden.

Today business is absorbing the largest share of the college product. By this measure, it owes higher education the largest share of debt.

There is no time like the present to face this obligation. The cost of leadership has gone up. Our colleges are in a squeeze. Many need libraries, classrooms and teachers.

These are the needs of a growing society. But automation is adding another demand, namely, that we educate our national manpower to wider usefulness.

College is business' best friend—support the college of your choice.

COUNCIL FOR FINANCIAL AID TO EDUCATION

Published as a public service in cooperation with
The Advertising Council and The Council for Financial Aid to Education.

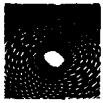
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

KEEP PACE WITH SPACE AGE! SEE MANNED MOON SHOTS, SPACE FLIGHTS, CLOSE-UP!

AMAZING OPTICAL BUYS

and OTHER SCIENTIFIC BARGAINS

EXPLORE THE WORLD OF "OP ART"



Fascinating New Experimenters'

MOIRE PATTERN KITS

Visual Effects!
Limitless Applications

Now! Experiment with the amazing new tool of tomorrow. Basis of "OP ART"—latest rage sweeping the country in art, fashion, packaging industries. 1,000's of uses for hobbyists, photographers, designers, lab and home experimenters. Fun! Profitable! Unlimited potential. Here's your complete introduction kit developed by Dr. Gerald Oster, Brooklyn Poly. Inst. Contains 8 basic patterns on both clear acetate lantern slide size 3¼" x 4" (.020 thick) and .012" thick white Kromekote paper 3¾" x 4½" (coated one side): two piece 3¼" x 4" 150-dot screen on film. Copy Dr. Oster's book, "The Science of Moire Patterns", an authoritative introduction to the fascinating world of moire.

Stock No. 70,719-A (KIT "A") .....$8.50 Ppd.
Stock No. 60,464-A (without book) .....$6.50 Ppd.

NOW AVAILABLE IN FULL COLOR

Wait till you see the fantastic rainbow of color—all 8 patterns above in full transparent colors, red, yellow and blue, plus black (total 40). Compl. instructions.

Stock No. 60,530-A (Kit A) .....$12.50 Ppd.

NEW DE LUXE EXPERIMENTERS' MOIRE' KIT "B"

Eight new totally different black and white patterns: Coarse sines; 65-line sines; perspective squares; medium grating; Gaussian grating; converging circles, elliptical zone plate; 30-line logarithmic spiral; plus instr. by Dr. Oster.

Stock No. 70,790-A .....$6.00 Ppd.

NEW MOIRE KIT "B" IN COLOR

8 new patterns above in red, yellow and blue; plus black (total 40) with inst. by Dr. Oster.

Stock No. 60,531-A .....$12.50 Ppd.

NEW JUMBO 20" x 25" MOIRE' PATTERNS

Excellent for displays and signs. Write for details. **MOIRE PATTERN ACCESSORY KIT.** For additional experiments. Incl. metallic balloon, calcite, two kinds of diffracting gratings, one-way mirror foil, polarizing materials, Ronchi rulings, assortments of lenses.

Stock No. 60,487-A .....$8.00 Ppd.

Terrific Buy! American Model OPAQUE PROJECTOR

Projects illustrations up to 3" x 3½" and enlarges them to 35" x 30" if screen is 6½" ft. from projector; larger pictures if screen is further away. No film or negatives needed. Projects charts, diagrams, pictures, photos, lettering in full color or black-and-white. Operates on 115 volt, A.C. current. 6-ft. extension cord and plug included. Operates on 60 watt bulb, not included. Size 12"x8"x4½" wide. Wt. 1 lb., 2 oz. Plastic case with built-in handle.

Stock No. 70,199-A .....$7.95 Postpaid

OPAQUE PROJECTOR WITH KALEIDOSCOPE ATTACHMENT

Same set as above, but provides endless additional projects with everchanging kaleidoscope patterns.

STOCK NO. 70,714-A .....$10.00 Ppd.

WOODEN SOLID PUZZLES

12 different puzzles that will stimulate your ability to think and reason. Here is a fascinating assortment of wood puzzles that will provide hours of pleasure. Twelve different puzzles, animals and geometric forms to take apart and reassemble, give a chance for all the family, young and old, to test skill, patience and, best of all, to stimulate ability to think and reason while having lots of fun. Order yours now. **Stock No. 70,205-A .....$3.00 Postpaid**

Bargain! 3" Astronomical Telescope

See the stars, moon, phases of Venus, planets close up! 60 to 180 power—famous Mt. Palomer Reflecting type. Unusual Buy! Equipped with Equatorial mount; finder telescope; hardwood tripod. Included FREE: "STAR CHART"; 272-page "HANDBOOK OF HEAVENS"; "HOW TO USE YOUR TELESCOPE" book.

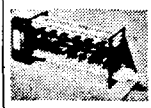
Stock No. 85,050-A .....$29.95 Postpaid
4¼" Astronomical Reflector Telescope
Stock No. 85,105-A .....$79.50 F.O.B.

SUPERB 6" REFLECTOR TELESCOPE!

Inc. electric clock drive, setting circles, equatorial mount, pedestal base, 4 eyepieces for up to 576X.

Stock No. 85,086-A ... $199.50 F.O.B. Barrington, N.J.

Solve Problems! Tell Fortunes! Play Games!



NEW WORKING MODEL DIGITAL COMPUTER

ACTUAL MINIATURE VERSION OF GIANT ELECTRONIC BRAINS

Fascinating new see-through model computer actually solves problems, teaches computer fundamentals. Adds, subtracts, multiplies, shifts, complements, carries, memorizes, counts, compares, sequences. Attractively colored, rigid plastic parts easily assembled, 12" x 3½" x 4¾". Incl. step-by-step assembly diagrams, 32-page instruction book covering operation, computer language (binary system), programming, problems and 15 experiments.

Stock No. 70,683-A ..... $5.98 Ppd.

'FISH' WITH A WAR SURPLUS MAGNET

Go Treasure Hunting On The Bottom

Great idea! Fascinating fun and sometimes tremendously profitable! Tie a line to our 5-lb. Magnet—drop it overboard in bay, river, lake or ocean. Troll it along the bottom—your "treasure" haul can be outboard motors, anchors, fishing tackle, all kinds of metal valuables. 5-lb. Magnet is war surplus—Alnico V Type—Gov't Cost, $50. Lifts over 125 lbs. on land much greater weights under water. Order now and try this new sport.

Stock No. 70,571-A 5 lb. Magnet ....$12.50 Postpaid
Stock No. 70,570-A 3½ lb. Lifts 40 lbs. ..$8.75 Ppd.
Stock No. 70,572-A 7½ lb. Lifts 150 lbs. ..$18.75 "
Stock No. 85,152-A 15 lb. size. Lifts 350 lbs. FOB $33.60

Revolutionary Technological Breakthrough in LIVING UNDER WATER

Underwater Ant Nest Used to Dramatize Development

Sensational new development may be forerunner to underwater cities, the day man will live under the sea. Silicone Rubber membrane enables ants (and other creatures) to live and breathe normally **by obtaining life giving oxygen from water** even though ant nest is submerged and sealed off completely from atmosphere. Complete instructions. Supply limited. Use your aquarium or order ours, listed below.

Stock No. 70,801-A
(Ant nest, membrane, instr.) .....$8.75 Ppd.
2½ GALLON PLASTIC AQUARIUM
Stock No. 90,014-A .....$7.95 Ppd.

Send check or M.O. Satisfaction or Money Back!
EDMUND SCIENTIFIC CO., Barrington, N. J.

Completely New—1966 Edition
148 Pages—Nearly 4000 Bargains
EDMUND SCIENTIFIC CO.
Barrington, New Jersey
Please rush Free Giant Catalog A
Name .....
Address .....
City ..... Zone.... State .....

ORDER BY STOCK NUMBER • OPEN ACCT TO RATED FIRMS • SATISFACTION GUARANTEED!

EDMUND SCIENTIFIC CO., BARRINGTON, NEW JERSEY 08007

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

analog
science fiction—science fact

JOHN W. CAMPBELL
Editor
KAY TARRANT
Assistant Editor
HERBERT S. STOLTZ
Art Director
ROBERT E. PARK
Business Manager
WALTER J. McBRIDE
Advertising Manager

NEXT ISSUE ON SALE
APRIL 7, 1966
$5.00 per year
in the U.S.A.
50 cents per copy

Cover by
Kelly Freas

Vol. LXXVII, No. 2 April 1966

NOVELETTES

MOON PROSPECTOR, William B. Ellern **8**
WHO NEEDS INSURANCE? Robin S. Scott **77**
A SUN INVISIBLE, Poul Anderson **108**

SHORT STORIES

RAT RACE, Raymond F. Jones **30**
THE EASY WAY OUT, Lee Correy **45**

SCIENCE FACT

DRIFTING CONTINENTS, Dr. Robert S. Dietz .. **58**

READER'S DEPARTMENTS

THE EDITOR'S PAGE **5**
IN TIMES TO COME **107**
THE ANALYTICAL LABORATORY **139**
THE REFERENCE LIBRARY, P. Schuyler Miller **140**
BRASS TACKS **147**

COPYRIGHT © 1966 BY THE CONDÉ NAST PUBLICATIONS INC. ALL RIGHTS RESERVED. PRINTED IN THE UNITED STATES OF AMERICA.

Analog Science Fiction/Science Fact is published monthly by the Condé Nast Publications Inc. Editorial and advertising offices: 420 Lexington Avenue, New York, N. Y. 10017. Executive and Publishing offices: Greenwich, Connecticut 06830. I.S.V. Patcévitch, President; Alfred W. Cook, Treasurer; Mary E. Campbell, Secretary. Second class postage paid at Greenwich, Connecticut, and at additional mailing offices, under the Act of March 3, 1879. Subscriptions: In U. S., possessions and Canada, $5 for one year, $9 for two years, $12 for three years. Elsewhere, $7.50 for one year, $15 for two years. Payable in advance. Single copies: In U. S., possessions and Canada, 50¢. Six weeks are required for change of address. In ordering a change, write to Analog Science Fiction/Science Fact, Boulder, Colorado 80302. Give both new and old address as printed on last label.

The editorial contents have not been published before, are protected by copyright and cannot be reprinted without the publisher's permission. All stories in this magazine are fiction. No actual persons are designated by name or character. Any similarity is coincidental. We cannot accept responsibility for unsolicited manuscripts or art work. Any material submitted must include return postage.

POSTMASTER: SEND FORM 3579 TO ANALOG SCIENCE FICTION/SCIENCE FACT, BOULDER, COLORADO 80302.

EDITORIAL AND
ADVERTISING OFFICES:
420 LEXINGTON AVENUE
NEW YORK, N. Y. 10017

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"THE BEST MADE PLANTS . . ."

Editorial by John W. Campbell

It was not just the New England Power Network that suddenly broke down on the evening of last November 9th. A number of very fine theories also broke down completely. The power network was back in operation within a maximum of twenty hours; the theories never will be in operating order again.

One of the consequences of this is that the electric-power engineers of the world—not just of New England!—are now living in fear, in an exact and technical sense. In total ignorance, there can be no fear. (A primitive Amazon River basin Indio has no fear of nuclear explosions, radioactive fallout, or invasion by extraterrestrial aliens.) In full knowledge, there is no fear; what you know and understand does not frighten you, because you know its limitations and possibilities, and know how to deal with it effectively.

Fear comes when you have learned that a menace exists, but you do not understand the menace, how it acts, what its limitations are, or what to do about it.

In that sense, world-power engineers, both in industry, in government, and in universities, are living in fear. The Great Blackout proves that a menace exists; they definitely don't understand it, nor, therefore, how to control it.

Somebody wrote an angry letter to one of the New York City newspapers after the blackout, charging that the "greedy" power companies could have prevented the whole thing if they'd just been willing to spend a little time and effort and computer-time running a mathematical simulation of the behavior of the network. That if

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

they'd done that they would have known that the Great Blackout could occur, and how to prevent it.

It was one of many letters damning the power companies for the occurrence; that one particularly annoyed me, because it attributed motive ("greed") to the power companies for not doing something the writer was sure they could and should have done.

A mathematical simulation works when, and only when, you can express the *actual* characteristics of the system being simulated in mathematical form that the computer can handle. "Can" in that statement needs the additional modification, however, of "can in practical fact." That is, theoretically a computer could be programmed to determine whether White, who moves first, or Black, who moves second in chess, would win if both players played an absolutely perfect game. Since chess is a perfectly logical "universe," in which we know *all* the laws, and *all* the "natural constants"—the moves of the pieces—a machine can be programmed to play out a perfect game, exploring all possibilities of all possible moves, of all pieces.

The difficulty is that even the fastest computers would take something on the order of ten thousand years to carry out the program.

The problem of that electric-power network differs in several ways:

1. We do *not* know all the laws of the real universe.

2. The power network problem does not involve a mere thirty-two pieces on sixty-four squares; it involves hundreds of generators, and thousands of load blocks, and scores of interconnections through lines that introduce various complex delays due to transmission time.

3. It isn't a "logical" system; unlike chess, the "players" don't take nice, neat, logical-sequential "moves"—the only kind of system a logical pattern can exactly represent. Things happen simultaneously, and logic can't handle true simultaneity.

There are three broad classes of mistakes; the Blackout revealed instances of all three.

Type I is the Unavoidable Ignorance type. So long as you're not omniscient, there will be things you do that you later discover were definite mistakes. A small child who sticks his finger into a live electric light socket makes an unpleasant discovery—that that's a definite mistake.

The Great Blackout itself was a result of a mistake of Ignorance; the network turned out to have characteristics that no one had ever imagined.

The Type II mistake is the Pure Goof. The individual does something, overlooking factors of which he was perfectly aware, but which he just plain forgot to consider in

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

relation to the problem in hand.

Example: One of the major Boston hospitals had installed a magnificent new emergency power setup only about two months before the Blackout—a setup capable of supplying all the power needs of the hospital. No doubt the plant engineer threw the new plant switch ON with considerable pride and satisfaction . . .

It didn't run.

The fuel pump that supplied fuel oil to the big Diesel engine was designed to be electrically powered.

If the Diesel and the generator were running, everything was fine. If the engine were started before the power line failed, everything was fine. But there was no way to start the thing after the power failed.

They got it going by chopping a hole in the fuel tank, dredging out some fuel, carrying it upstairs, and pouring it into a funnel and down a long rubber tube. That gave enough pressure-head to force the starting fuel in.

Another hospital—New York this time—had their emergency power generator equipment in the basement. This was all right; the plant started up satisfactorily . . . but didn't run very long. The basement was below the level of the adjoining river, and was normally kept dry by continuous pumping by electric-powered pumps. Somebody had classified these pumps as non-essential accessories, and their line wasn't tied into the emergency-power board. Before it could be, the generator was drowned out.

Those are plain, all-too-human goofs, resulting not from basic ignorance, or rejection of responsibility, but from simple mental slips.

Neither of those two types can be classified as bearing any onus of guilt. Responsibility, yes—but not guilt.

Type III mistakes are those resulting from refusal to accept responsibility—by insisting that the responsibility "should be" some one else's.

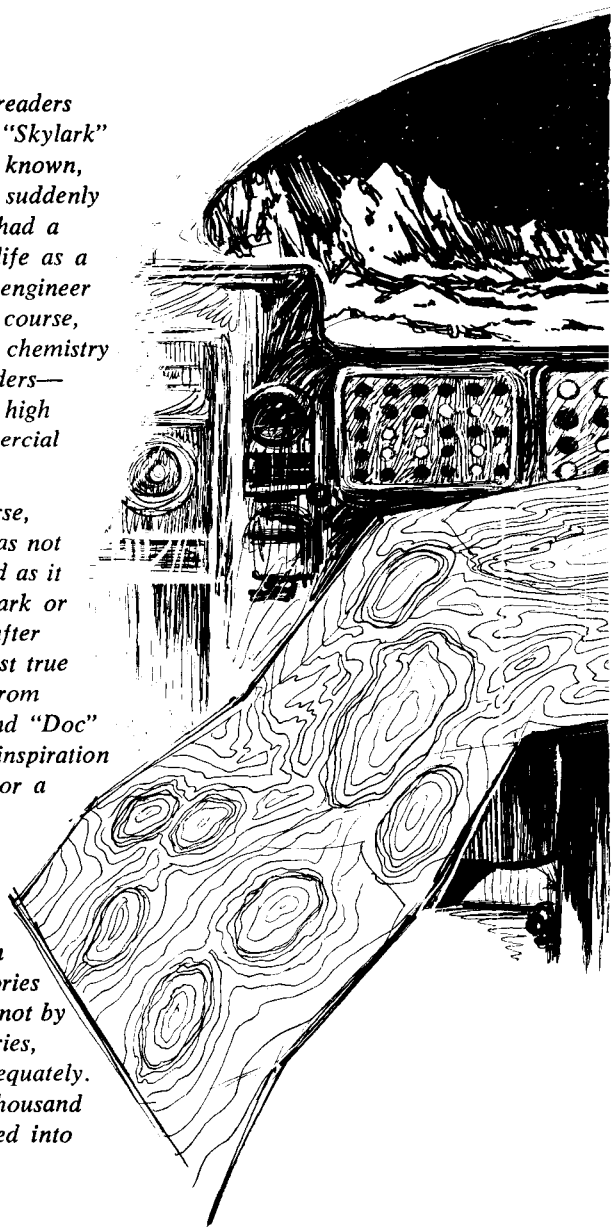
By a sheer God-granted miracle, none of the millions of people affected by that blackout were killed. That is, perhaps, the most incredible aspect of the whole affair.

It just happened that that early November evening, the skies over all of that eighty thousand square mile area were perfectly clear, and that a brilliant, nearly full moon shone in the sky. Had it been a night of typical November cold drizzle, it's highly probable that hundreds of people would have died in air crashes that night. There were several hundred planes in the air over that territory . . . and abruptly all the lights went out on all the airports. Moreover, simultaneously all the radio navigation equipment went dead, the control-tower communications died, and the ground radars went black.

continued on page 154

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Moon Prospector | William B. Ellern



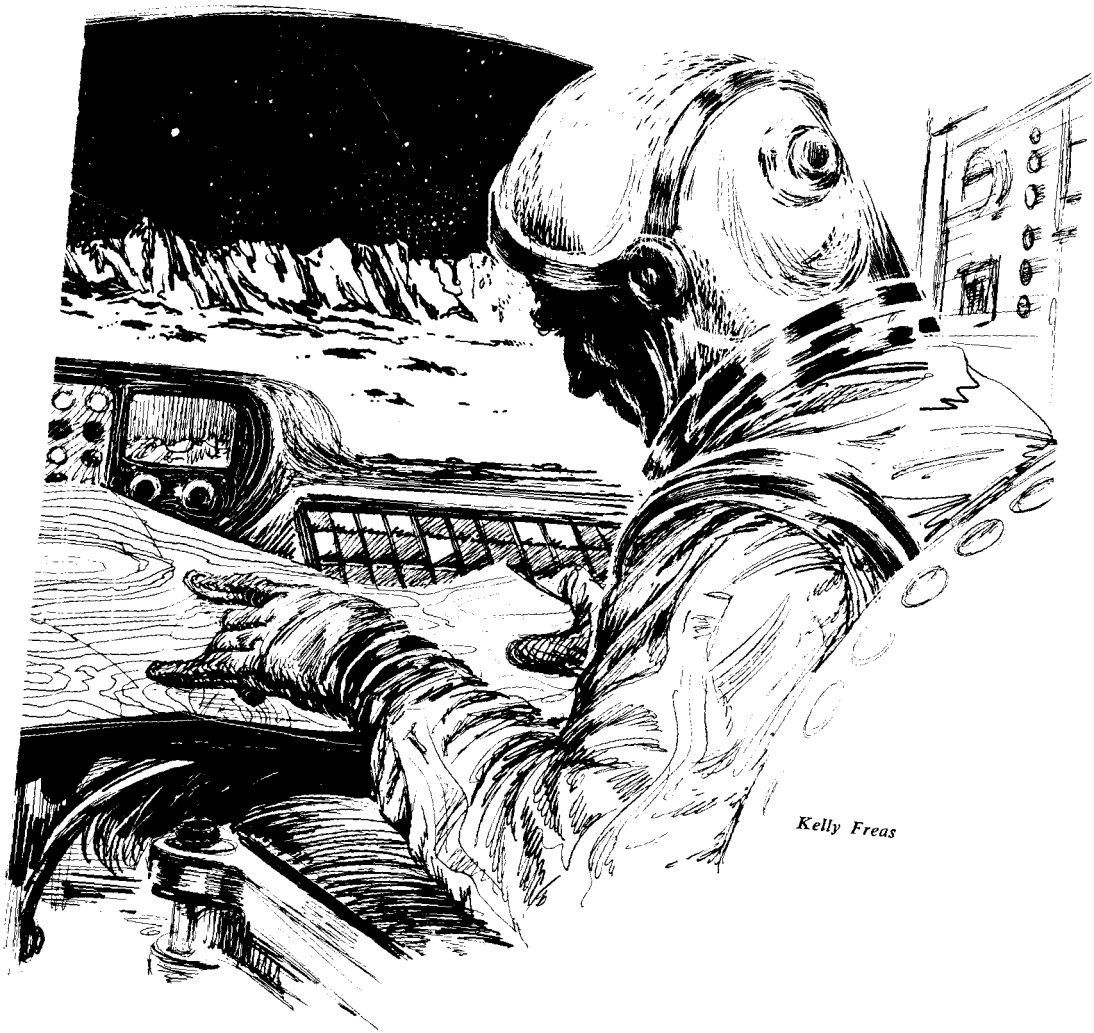
Foreword

As most science fiction readers know, Dr. E. E. Smith, "Skylark" Smith as he came to be known, died early last fall, very suddenly of a heart attack. He'd had a long, full, and effective life as a manufacturing chemical engineer and researcher—and, of course, science-fiction author. In chemistry his specialties were powders—with a wide range from high explosive types to commercial doughnut mix types.

In science fiction, of course, his scope was wider; it has not been as widely recognized as it should be that his "Skylark or Space," written shortly after World War I, was the first true interstellar—as distinct from interplanetary—story. And "Doc" Smith's stories were the inspiration and triggering stimulus for a whole generation of science-fiction writers—including myself.

But when an author creates whole universes in which to sweep out his stories of immense scope, he cannot by the very nature of his stories, fill in the details at all adequately. Inevitably, he leaves a thousand backgrounds barely flicked into

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



Kelly Freas

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

sight by the passing sweep of his story—undeveloped, unilluminated.

Curiously, all those thousands of worlds that Doc Smith suggested, have never been explored or developed.

Last summer, I received this manuscript from Mr. Ellern—of whom I'd never heard before. It was, as Mr. Ellern clearly stated, laid in Doc Smith's "Galactic Patrol" universe. He was developing one of the side-fights of that long, epic war between Boskone and the Patrol.

But—it was *Doc Smith's private and personal creation, that Universe. Knowing Doc as well as I did, I was quite sure he'd be agreeable to Ellern's use of it—because Ellern had a good yarn to tell. So I suggested to Ellern that he write Doc Smith and get his permission to "move in on" the Galactic Patrol Universe.*

Just four days before Doc died so unexpectedly, his permission for the first non-Smithian story of the Galactic Patrol story was sent to Ellern.

Naturally, Doc had some suggestions to make—so you might properly say that this story is one Analog story that was edited by Doc Smith, instead of by

THE EDITOR.

6426 N.E. 22nd Avenue,
Portland, Oregon 97211,
July 14, 1965

TO WHOM IT MAY CONCERN:

I hereby give William B. Ellern permission to lay his stories in my Lensman universe; and to use copyrighted material identical with or similar to that embodied in his manuscript now entitled MOON PROSPECTOR.

Edward E. Smith.

■ "Storm!" the moon creeper said.

Pete Miller was buzzing along at five miles per hour, his tracked moon creeper following the low cliff wall on his right, through the Carpathians. He was on his way to Copernicus where he planned to refuel for another prospecting trip. Behind the tank, two trailers followed, one containing reserve supplies, and the other automatic mapping and prospecting equipment such as magnetometers, radar topological plotters, laser-spectro-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

scope samplers, et cetera. The crevasse detector on the boom in front of him had not stopped the tank in over half an hour.

Pete was an old-timer. He was a boy when Gillespie diverted a couple of megabucks of public funds to buy a Surplus rocket and outfit it to go to Mars. His reverie was broken by the voice of the moon creeper.

"Copernicus reports a large meteor fell in the plain about one hundred miles west of them. They advise all vehicles to head for cover," it said.

"That cliff might have enough height to protect us," Pete said.

"My profile mapper indicates that that spot is the best place along the cliff," the creeper said. Simultaneously a marker of bright light appeared on the cliff face about five hundred yards ahead and the creeper turned toward it. As they crossed the pass to the point of relative safety, both the prospector and the moon creeper were silent. They were waiting for the secondary meteorites thrown up by the first meteor to begin to fall. Having a range of fairylike mountains between them and the meteor had protected them from immediate showers, but eventually the stuff with a ballistic trajectory high enough to clear the range between them would begin to come down. When it did, it would come down hard!

Three minutes later the creeper and its carriers were pulled up under the protecting wall of the cliff in a compact little group.

"That isn't much of an overhang," Pete said.

"No, but it is the best within twenty minutes travel," the moon creeper answered. "Also the profile of the ridge above the cliff gave us about a minute extra before the first of the shower hit us."

Even as the creeper spoke a number of small puffy clouds appeared in the pass. They rose from the surface and then seemed to evaporate. The edge of the clouds crept closer with each passing moment. Occasionally the ground shook.

"Copernicus reports that all four western entrances are blocked!" the creeper reported.

Pete looked out at the cloud and said, "That must have been a hell of a big one! How could the entrances be blocked? They have a fifty-foot overhang of twelve-inch reinforced concrete!"

"They were apparently directly downstream of the storm. They've had slides, and lots of stuff skipping in. Entrances Number 2 and 3 even have the air-lock door destroyed."

"How long to dig out?"

"Three or four days if they have to dig out from the inside, four hours from the outside. They're checking prospectors for digging tools . . . No luck. They're going to send a digging party out the north pass and around. They give

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the storm another fifteen minutes," the creeper reported.

"Are the emergency catches intact?"

"Yes, so far. But they may not be accessible."

The storm had reached its peak intensity and was now visibly dying. The nearest portion was still one hundred feet distant, but small bits of splashed material made little splattering noises as it hit the sides of the moon creeper. Fortunately there were no rocks as such, only fibrous material in this area. Pete was getting nervous, as he usually did during a storm. He started to get up, thought better of it, and then deliberately relaxed. "I've been in tighter situations than this," he told himself. Somehow that seemed rather unimportant. After an age he glanced at the clock. Ten more minutes. Impatiently he said, "Well, while we're sitting here, let's transfer supplies."

Transferring supplies was still a manual job. The automatic loading equipment needed was too big and expensive for a small operation like this.

It took Pete all of two minutes to get into the light-armored vacuum suit and to check it out. Another two minutes was spent pumping the cabin air into the recycle tanks. Another minute and Pete was crawling along the creeper's treads, next to the wall of the cliff, toward the creeper's tender. A jump and he was on the tender's treads. He undogged a port in the side of the tender, swung the eight-inch thick door back, and plugged in the hoses that trailed back of him to the moon creeper. Reaching past the hose connections, Pete pulled out a suitcase of frozen food.

"I hope they packed something in this one besides peanut butter sandwiches," he said. His cynicism was lost on the moon creeper. Pete returned. The hoses would automatically decouple and follow him when the refueling was complete.

Back inside the creeper things were quiet, as usual. "So much for that month's work," Pete said as he shoved the frost-covered suitcase into its storage place. The moon creeper didn't comment. A few minutes later they started moving.

"I gather our present plans are to continue back to Copernicus and help dig out one of the west entrances?"

"No, the work crew can handle that. Copernicus Control has directed us to delay and continue our current prospecting program until we're called back," the moon creeper answered.

Pete sighed. He was anticipating a week end in the Copernicus base.

"However, now there is some question whether Harvey Reinfield got under cover in time," the moon creeper continued. "He was about one hundred miles northwest of

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

here, at Mayer A. No one can raise his creeper."

"Harv?"

"The satellite will check him in about three minutes."

"Damn! Tap their picture when they get it. I want to see it," Pete said.

"We are the closest party to him in this area, so we will probably be asked to pick him up," the moon creeper said.

Pete leaned over the control console waiting for the new satellite picture. "Harv's probably just got communications trouble. Is his tender's emergency transmitter going?"

"No."

"So either both he and his tender got caught in something together, or he's O.K."

A few minutes later the strip map was replaced by a television picture from the satellite. Rapidly the camera found the trail leading into Mayer A, and then followed a particular pair of tracks. They ended in a pile of rubble at the inside face of the crater cliff. The tender and another carrier were a couple hundred feet away. Pete snorted.

"Has the satellite got a good enough antenna to pick up Harv's interphone?"

"Yes, Copernicus Control is already trying to break in."

"Break in?" Pete asked.

In answer to Pete's question the moon creeper switched in the radio system direct. A string of profanity was being transmitted. Pete was surprised, and then he smiled as he recognized Harv's voice, and settled down to wait for it to stop. He noted several new words and made a mental note to ask Harv about them later.

A couple of minutes later there was a temporary lull and Copernicus Control was so ill advised as to ask what happened. After detailing the controller's incestuous ancestory, the answer came. ". . . What do you think happened? I got caught in this . . . slide!"

"I noticed something of the sort. Are you in trouble?" asked Copernicus Control innocently.

There was a long silence as Harv assimilated all of the implications of the question. He finally said, "I'd like to tell you to take a running jump, but it happens that I'm in trouble and do need help." There was a long silence during which Copernicus Control kept silent. "I was spiraling out of Mayer A when I saw a flash reflected from the north wall. I stopped figuring that the rim would give me some protection. A couple of minutes later the slide started. I tried to get out of its way, but didn't make it. It took off my antennas, treads, and my shield. I'm now lying on my side, completely buried. I have three weeks' food and air, with no apparent leaks," Harv reported.

"Pete Miller has been listening in," Copernicus Control said.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"What equipment will you need to dig the biggest mouth on the moon out of his rockpile, Pete?"

"What?" Harv said.

"Relax, Harv," Pete said. "We'll all do our best to extricate you from this trouble your stupid lack of judgment got you into."

"What do you mean big-mouth and stupid?" shouted Harv.

"It looks like I'm going to need a full range of digging equipment," Pete continued, ignoring Harvey, "starting with blasters, and working down to needle samplers. Some jacks, a portable spy ray, be sure to include a shadow magnetometer, blast shields, a small tractor beam, something to haul the creeper back on, since it's too expensive to abandon . . ."

"Hm-m-m!" said Harv.

"Some sheets of plastic and adhesive, a couple of twenty- or thirty-foot steel wrecking bars, cable, a couple small winches, a dozen explosive anchors, a portable crevasse bridge. Make that two bridges." Pete said. "Any idea how deep you are, Harv?"

"Nothing but rock in sight," Harv answered.

"Have I forgotten anything?" Pete asked.

"Yeah," Harv answered. "A flask of brandy for the poor victim!"

"I'll send the stuff around after our digging party. They've already left. Where do you want to pick it up?" asked Copernicus Control.

"If it takes only four hours to dig out the first entrance, it'll be just about as fast to send it out that way. That'll also give me time to get out to Mayer A and survey the situation. Then I can ask for anything else I may need. I can also check the trail from Mayer L on out for any new chasms or slides, which means that the man bringing the stuff out will be able to travel most of the trail at high speed. I'll need about twenty-four hours plus to get out to Harv, and the first entrance should be open at about the same time."

"We figure twenty-eight hours from now, plus or minus an hour," Copernicus Control said.

"It'll take about twenty-two to twenty-four hours after the entrance is open for him to get to Mayer A. By the way, Harv," Pete asked puzzled by a sudden thought, "what were you doing out at Mayer A? It's already been surveyed a couple of times."

"Can't tell you, Pete. Ask the mayor," answered Harv.

"I've got other work to do. Will check back later. Bye," Copernicus Control broke in and cut off Pete and Harv.

"What the hell goes on here?" Pete said. He sat in front of the television screen where the moon creeper again displayed the strip map of the area. This was a surprise! Someone, maybe the mayor of Copernicus, had some reason for getting Harv out to Mayer A in

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

such a hurry that no one had bothered to provide him with a cover story. Actually, a moment's reflection told Pete, there would normally be no reason for a cover story. No one except Harv, the mayor, and Copernicus Control need know anything about the trip. It was only because of the meteorite storm and the accident that anyone else knows even now, Pete thought. At this point they can't say much over the radio, but they can send someone special out with the digging equipment. They will probably suggest a story to Harv. They would not have to say much. Harv was mighty fast on the uptake, and could spin out a yarn with the best of them. Except Harv wasn't anything else or anyone else than Harvey Reinfield. Oh well, Pete shrugged to himself, it will all come out. That a secret exists is half the secret.

The moon creeper was already on the road. They had started out when the storm quit.

"Tune me in on any conversation between Copernicus, the Control, or anyone, and Harv," Pete ordered. "I want to listen in, not a synopsis."

The moon creeper woke Pete up four hours later as Copernicus was calling Harvey Reinfield. The conversation went about as expected.

"Harvey, this is Ron Love," the Mayor of Copernicus said. "Did you find anything?"

"No," answered Harvey.

"Pete Miller should be out there in about twenty hours. You can tell him anything when you talk to him over the interphone."

"Anything," Pete noted, meaning anything except the truth, and the interphone bit was so the people back home could make up a story accordingly. The normally private conversation over the moon creeper radios would be picked up and relayed by the satellite.

"O. K., I'll see what I can do," answered Harv and signed off.

Pete started to go back to sleep, and then said to the creeper, "Remind me in the morning to ask for a bunch of floodlights, when I talk to Copernicus Control. I see we got around the ridge. Are we on the track out to Mayer yet?"

"We will be on the trail in half an hour," answered the moon creeper.

"Wake me if we hit any new large crevasses," Pete said and went back to sleep.

When Pete woke up four hours later they were traveling on the trail. He checked time and position. There had not been any new changes to the trail so far, other than a few minor meteor holes. He was tempted to have the moon creeper step up the speed, but then he would be running faster than his crevasse detector could stop him. Better safe than dead. Instead he instructed the creeper to "whistle up Copernicus Control."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Copernicus Control," the man on duty answered.

"This is Pete Miller on my way to Mayer A to dig out Harvey Reinfield," Pete said. "In the supplies you send out, add a dozen or so floodlights with stands."

"I gather you expect that it will take more than a week to dig him and the creeper out?" Copernicus Control said.

"Yeah, it depends on the size of the slide, and how deep he is."

"O. K." said Copernicus Control. "Suppose we also send out an inch-worm rescue tube?"

"A what?" asked Pete.

"An inch-worm rescue tube. You've seen the digging machines used to make the tunnels here at Copernicus. They dig a pilot hole, clamp onto the sides of it, and pull the big cutting face up to the rock wall. When the big cutting face catches up to the pilot hole, the little cutter uses the big machine's mass to cut another pilot hole in the rock. It's called an inch-worm because it inch-worms its way through the rock, see?"

"Yeah," said Pete.

"Well, this is a miniature version of the big digger. It drags a slick plastic tube behind it. On earth they use teflon. Here the rock is below −100°F so we have to use slipon. Teflon begins to cold flow. It's used to supply air to trapped miners. Goes through rock like a bat out of you know where," Copernicus Control said.

"But Harv is buried in loose rock," said Pete.

"It has a special spiked head for that," Copernicus Control explained. "It'll dig all the faster."

"O. K., any other gadgets I haven't heard of?" asked Pete.

"Nope, call me when you get to Mayer A," Copernicus Control said.

"How come you don't use a full-sized digging machine to get the entrances clear?" Pete asked.

"It would take too long to wrestle one up to an entrance," came the answer. "They are all down south clearing out a new lab."

"Right. Thanks. Bye," Pete said and signed off.

"How long is the period between observing satellites?" Pete asked the moon creeper a little while later.

"They overlap," the moon creeper said.

"How come there was a delay yesterday in talking to Harv?" asked Pete.

"The slope of Mayer A's walls is such that it takes about eight minutes after the first satellite goes down until the next satellite rises from the horizon to see down inside it," was the answer.

"Can we manage to be passing Harvey's carrier while neither satellite is watching?" Pete asked.

The creeper was silent for a moment while calculating arrival times and satellite transitions. "Yes," was the answer. "If we speed up anoth-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

er tenth of a mile per hour, there are no slides on the trail near the crater, and have no trouble getting over the rim of the crater."

"O. K., arrange it so we are just passing Harv's carrier as we go out of sight of the satellite. I want to check inside without having anyone looking over my shoulder while I'm doing it," Pete said. "After we check it, we hustle over to the slide and make tut-tut noises with Harv until the digging equipment arrives."

Traversing into a crater is a particularly ticklish operation. The inside of a crater is usually smooth, circular, and steep. The outside is usually somewhat rough and not so steep. If the height from the outside to the rim of a crater is considered one unit of distance, the depth from the rim to the bottom is about three units, and the diameter is about twelve units. The walls are over 45° in slope near the rim. Pete's moon creeper climbed the outer wall, started around the rim picking up speed, and then dropped inside. It spiraled down the steep face until he could stop without sliding.

"We are right on schedule," the moon creeper reported to Pete. Pete was suited up ready to get out. The moon creeper reported the satellite out of sight and stopped at Harvey's carrier almost simultaneously. Pete got out and jumped to the carrier. He unlatched the top, and activated the jacks. The top lifted and Pete spent a minute looking at the insides. After the initial surprise, he examined it with extreme care. He made certain there were no mechanisms attached to the lid which might leave evidence that it had been opened. There were none. He went back to the moon creeper, got a spare control unit, and exchanged it for Harvey's. He noted the information on the nameplate of the "carrier," and then closed the lid.

Pete was back inside the moon creeper with minutes to spare. The cabin was re-pressurized, and as Pete stripped off the vacuum suit he said, "Get moving at high speed toward the slide. We've got some apparent time to pick up. As soon as I get this suit off, contact Harv. Can you handle a SP/RFU-16?"

"Yes, that's part of our background instructions," answered the moon creeper.

"Your auxiliary channel two is connected to one. That so-called carrier out there is a Solarian Patrol remote fighting unit. Whatever Harv was doing, he was really loaded for bear!! That 'carrier' could have been square in the path of the slide, and not a rock touch it!" Pete said. "Suit's off and stashed."

"Here is Harvey," the moon creeper announced.

"Hi, Harv. Quite a rockpile you've got there!"

"Hm-m-m! Stupid huh!" answered Harvey.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Come off it, Harv. You know we didn't mean it when we kidded you. If you were so stupid, you wouldn't have survived to become an old-timer," Pete answered.

"Go on . . ."

"What do you mean?"

"It's nice to hear something complimentary about yourself, even if it is left-handed," answered Harv.

"So you're kind, brave, obedient, reverent, thoughtful, clean, honest, and true, and everyone loves you all to pieces. O. K.?" Pete said.

"Nuts!"

"Any idea where in the slide you are?" asked Pete.

"No," Harv answered.

"Creeper, plot his radio direction. We'll have you pinpointed in a couple of minutes," Pete said.

The creeper ran along the edge of the slide for several minutes while Pete and Harv continued talking.

"Indications are that you are about as near to the center of the slide as you can get. You're about three hundred feet back from the nearest edge, and maybe about forty-five feet down, give or take a couple of feet in any direction. When the equipment gets here I'll be able to locate you closer with the portable spy ray. Is the satellite up yet?" Pete said.

"Yes," answered the creeper.

"Show them our view of the slide, and tell them to hurry it up," Pete said.

"Copernicus Control wants to talk to you," said the creeper.

"O. K. Put them on," Pete said.

"We were listening to you when you placed Harv's location in the slide. It looks like you just have to cut through to him and drag him out," said Copernicus Control.

"Not quite. We lucked out in that he isn't at the bottom of the slide, but it still isn't quite that simple. I'll talk technique when I have some equipment to work with. Is the equipment on its way yet?" Pete asked.

"No, you've got another two hours before the entrance is cleared," answered Copernicus Control.

"Then there's not much I can do except to survey the slide on foot, and try to figure out how we're going in after Harv," Pete said.

"We'll call back when the entrance is open. Bye," Copernicus Control said and signed off.

During the following hours Pete explored the slide and the area where the slide started. He saw nothing except a jumble of rock. Copernicus Control called to announce that the equipment was on its way. Pete estimated cutting times, equipment placement, talked to Harv and slept.

The equipment was brought out by a man Pete had never seen before, in a moon creeper unlike any other. It had eight wheels, four of which were raised in the "air."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The driver, a tall, alert, wiry man with an air of authority, introduced himself as Steve Tolliver. As he got out and walked toward Pete, it was obvious that he had had little experience walking on the moon with a vacuum suit and "moonshoes". He seemed to catch on fast.

"What is it?" Pete asked, waving at the eight-wheeled vehicle.

"It's a relic. A two-hundred-year-old Northrop Mooncar. It was built for the Apollo Program back before World War III. They found two of them when we got here. The other one is back in the new Smithsonian on Earth. This one was dug out and renovated for this run. I made sixty-five on the trail you checked. They have four wheels for high speed travel, then wheels for heavy going, and on dust you can turn the wheels around a common center and paddle out. I don't understand why they aren't used instead of tracked crawlers."

"Politics!" Pete commented. "President Witherspoon has a nice work project going in North America, and he doesn't want to lose it. We have to renovate every creeper we get. Half of them aren't even airtight!"

Pete spent an hour surveying the inside of the slide around Harv with the shadow magnetometer. He located and marked Harv with careful accuracy using the spy-ray attachment, but there were other objects in the slide which Pete couldn't account for. Pete searched somewhat far afield knowing Tolliver was watching him, until he found one of the objects near the surface. He moved a couple of rocks away, and found a small piece of what looked like the side of an old sewer pipe! Having anticipated the problem, his body shielded what he was doing from Tolliver. A hand signal to the creeper caused it to flash-analyze the object. Pete then dropped the "piece of pipe" and half covered it with several other rocks he "examined."

A little later Pete explained to Tolliver and Harvey what he planned to do to extract Harvey. "It will take too long to just cut through the slide, in spite of the power we have available. In addition, the average ground temperature is −100°F., it will take over twenty-four hours before the walls and floor of the slice would be cool enough to do the fine work of making an escape hole for Harv. We can cut a series of small holes faster than large slices, and the cooling time will be smaller. This will save time, since the necessary final clearances and cuts have to be made with the same accuracy in either case. So, first we cut a drain hole at the bottom of the slide under Harv's position. Then a small hole connecting to it about ten feet from the exit side of Harv's creeper. We enlarge the hole keeping about ten feet away. The original hole

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

acts as a drain. When we get a little below Harv's level, we stop cutting and use a tractor beam mounted on a crevasse bridge to pull rock into the hole we cut. The creeper should only be exposed to about two thousand BTU per hour, which it should be able to take care of with ease. We melt and flush the rock down the drain. Once Harv's out we cut a ramp in one side of the hole, wait until it cools, and then pull the creeper out using a couple of winches.

They were enlarging the drain hole when Pete took off a few minutes to go back to his creeper. "What did the analyzer show?" he asked the creeper when he was inside.

"It was a cobalt alloy," was the answer.

"Make that information a secret . . . to S. P. officers only," Pete said. "Use your radiation probe on the lava we dump. I think we've found one of the old, pre-World War III, American missile sites. Possibly the main one that was built just before the blowup. I don't know who Love and Tolliver are working for, and I don't know why the secrecy, but we'll keep on acting as if this were only a rescue operation, and see what happens. Keep an eye on Tolliver. If he does anything too unusual, or potentially dangerous to me, let me know by clicking twice on the vacuum suit radio," Pete said.

"I've been talking to the Moon-car," the creeper said. "Tolliver seems normal, but inexperienced."

"That's what makes me wonder about him," Pete said. "I can't think of any reason Love would send a new recruit out to me, especially under the circumstances."

Pete went back to work. An hour later they quit to wait for the walls of the hole to cool before putting the crevasse bridge across it.

"Why did you use the shadow magnetometer instead of a spy ray?" Tolliver asked.

"Mostly habit I guess," Pete answered. "Spy rays are all right if you want to look at something and you know where it is. I wanted to survey the whole area and a spy ray just doesn't let you do that. You want to use it?"

"Yeah. I thought I'd go up and look over the area where the slide started."

"O. K. Mind if I tag along?" asked Pete.

"No," Tolliver said.

"If you'll wait a couple of minutes, I'll get some tools," Pete said.

When Pete got inside the creeper he said, "I'll try to stay in sight. Have the fighting unit cover us, even if you have to move it. *Keep us in sight!* Any questions?"

"Do you expect trouble?" asked the creeper.

"Yes, probably from Tolliver. I think he is a ringer," Pete answered. Pete selected tools for the belt he

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

put on. "Some of these things can be used as weapons. I'll try not to turn my back on our friend out there. If anything happens to me, call the S. P. direct and tell them what we know and suspect. If I find evidence of the base, I'll make a comment about getting warm from the climb. If we find it, I'll say 'I'm hot.' Send me one click repeated at one-minute intervals whenever the satellite goes down, and three together when it comes up again. See you later."

Pete and Tolliver went over the slide, and up toward the rim.

"What are the black pieces on the screen?" Tolliver asked, while he was examining the area.

"Probably iron ore," Pete answered. "From the size of the pieces, there may be a vein of it above us." Pete didn't mention that unrefined ore would be much lighter in color. "Let's go take a look."

They continued climbing. The area from which the material in the slide came was obvious. The crystalline "fairy castle" material ended abruptly at the edge. They stopped on a flat rock near the top. Tolliver examined the area and said, "Is that a vein up there? You look."

Pete took the instrument. "I'm getting warm from the climb. That's a strange vein. Let's get a little closer."

The object was buried about a foot below the surface. As they dug Pete heard a click from the creeper. "It's a cable. Let's follow it." Tolliver agreed, and they set off, Pete carefully bringing up the rear. It shortly became obvious that it was a very long cable.

"Creeper, use a spy ray and follow this line," Pete said.

"The cable goes around to the peak on the west side of the crater," the creeper reported.

"What do you think?" Pete asked Tolliver.

"I think the hole has solidified enough for you to mount the crevasse bridge and get me out of here!" Harv broke in before Tolliver could answer.

"O. K., be right down," Tolliver answered.

The moon creeper was waiting for them as they came down the steep side. They rode on its radiation shield back to the slide.

Tolliver's attempt to kill Pete was performed very smoothly. They had just bolted the tractor beam in place on the crevasse bridge over the red-glowing pit. Pete was cutting away part of the bridge rail when Tolliver "bumped" against him. Pete went over the edge. The power line on the cutter held.

"Pull me up!" Pete shouted.

Tolliver looked over the edge. "Just a moment," he said and disappeared.

Pete heard two clicks as he climbed the power cord and grabbed onto the bar under the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

bottom edge of the bridge. The power cord came loose and the cutter fell into the pit. Tolliver again looked over the edge. He saw Pete holding on to the bridge. He picked up the spanner wrench used to tighten the tractor beam bolts, and swung it at Pete's hand. Pete shifted his hold at the last instant and grabbed for the wrench. He missed.

The second blow was aimed sideways at Pete's arms. Tolliver hoped to sweep him off the bridge. Pete let go and grabbed with both hands at the wrench. This time he got it, and then Tolliver's wrist. Pete yanked—Tolliver, off balance, grabbed for the railing. It burned through his glove. Tolliver toppled. Pete grabbed the edge of the bridge again. When he got on the bridge and looked back, there was no sign of Tolliver. Then he heard three clicks.

Pete hesitated for a couple of moments, and then he said, "Report back to Copernicus that we just had an accident. Tell them that Pete Miller fell into the pit. Apparently dead. Tell them I'll give more details when I get inside."

"What happened?" asked Harv.

"Shut up!" said Pete and went back to work.

An hour later the rock was removed from the door of the entombed creeper, and Harv had climbed a line out of the slide. Pete waved him toward his creeper.

Once inside Pete's moon creeper they removed their face plates. Pete came to the point immediately. "What is going on around here?" he asked.

"Someone is apparently planning to invade us," Harv answered.

"Who?" Pete asked.

"I don't know," Harv said. "I don't think Mayor Love knows either. Someone has been sending agents into Copernicus in an apparent attempt to either take over, or to destroy it!"

"You don't have any idea then who they are, or where they come from?" Pete asked again, somewhat disappointed.

"No, remember the universe is a big place," Harv answered. "An invader who advertises where he came from before he takes a bite out of his victim is inviting a bite back."

"How did you get involved?" Pete asked. "You're just another prospector like me."

"Yes, but for the last ten years my hobby has been looking for the pre-World War III moon base," Harv said. "Some people Earthside found new information about its location. The Galactic Patrol passed the information on to Mayor Love, who passed it on to me with the directions to find it, and secure it."

"Galactic Patrol? What Galactic Patrol?"

"You're just full of questions, aren't you? Have you been listening to the *Earthside News?*" Harv asked.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"No," Pete shot back. "Why?"

"About an hour ago there was an attempt on the Solarian Councillor's life," Harv said. "The Commissioner of Public Safety has ordered out the entire Solarian Patrol. It has been renamed the 'Galactic Patrol', and is on emergency call-out drill. The Hill is closed, and the Grand Fleet is out waiting for someone to show up from deep space. It looks like the skirmishing between individuals is about to stop, and the curtain is going up on the real action."

"O. K., how fast can you get the Solar . . . er . . . Galactic Patrol here with weapons and armor?" Pete asked.

"I can't," Harv answered seriously. "They have their hands too full with the fleet operations to be bothered with a couple of prospectors and an obsolete moon base. Copernicus will probably be under attack shortly. If Copernicus is destroyed, and they control the moon base, they will be able to use it as an advance outpost for their next attack. It could be easily reduced right now, if the Galactic Patrol had the time, and knew where to look. It took me a week to find it even with all my information on the subject, and only Copernicus Control, and apparently the enemy, suspect that I've found it."

"In other words, we're on our own to secure the moon base, and defend it with obsolete weapons and our own resources," Pete said.

"And if we don't, they'll wipe us out because we know too much," Harv added with a sad smile and a shrug.

Pete paused for a moment and then shrugged back. "O. K., that's the way it is," he said. "What do we do first?"

"Copernicus Control should be real busy right now with Galactic Patrol work, which means that after we report that I'm O. K., we'll be ignored. Whoever substituted that character for Tolliver will expect him to report to them shortly, so we better start for the west peak pronto."

"I'll install a remote-control unit on the blasters to cover our rear, and on your tender, so you can take it along," Pete said. "You go on ahead in my moon creeper, and I'll catch up with you in Tolliver's Mooncar. Where do you think the entrance to the moon base is?"

"On the other side," Harv answered. "At least that's where I plan to look for it."

"O. K.," Pete said. "Creeper, take the fighting unit and the tenders, and follow Harv's orders. The blasters will be on auxiliary channels Six and Eight. Harv's tender will be on channel Nine. See you, Harv." Pete grabbed up an armload of control units and left.

Harv and the moon creeper spiraled up over the west rim following the cable with the spy ray as

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

far as he could into the dense mass of concrete and steel he found there. Pete followed a few minutes later in the Mooncar. Apparently a large portion of the west peak had been hollowed out for the moon base. Harv found the entrance. It was a hole three hundred feet high and fifty feet wide in an east-west cliff face. It was oriented to look like a huge shadow, a wrinkle in the wall. The area leading up to the entrance was crushed rock, so no tracks were left. The crushed rock formed a long slow ramp in the opposite direction toward the main Mayer crater. The moon creeper and the Mooncar entered the cliff face entrance and turned on their lights. At one side of the cavern two spaceships stood. The walls and ceiling looked as if the cavern had originally occurred naturally in the crater face. The vehicles proceeded down the cavern and around a corner where there was an air lock able to take a complete vehicle, if necessary. It stood open. Around it were parked three other Mooncars, and a dozen tracked vehicles. Harv and Pete pulled in next to them.

"Leave the creeper to defend the entrance with the fighting unit," Pete said. "We'll see what's inside."

"O. K., while they're getting positioned, help me unload my tender," Harv replied. "I was expecting to explore this place."

The tender contained six "pack mules," eight-wheeled, articulated vehicles designed to be able to travel through narrow corridors or caves, and loaded with gear which Harv had accumulated in anticipation of exploring this place.

There was no air inside the base. When it was abandoned, all the air had been pumped back into storage tanks, which in the hundreds of intervening years had leaked their contents to the vacuum outside, and the power had been turned off. Harv started his examination of the blackness ahead with a portable spy ray. The first thing they did was follow a long passageway using their vacuum suit lights. After they had reached the door at the other end Harv explained, "When the system power is on, this passageway is a neat little deathtrap. They didn't like uninvited guests."

When they were outside of the passageway, Pete opened a light fixture and connected in a small generator to the wires, while Harv again explored with his spy ray. The lights came on. "Find the light switch and turn it on so the rest of the lighting system will have power," Pete said.

"The power plant must be on one of the lower levels. There's an elevator about a thousand feet ahead," Harv said.

A few minutes later they were at the elevator. "The power plant is down about three-quarters of a mile," Harv reported. "I doubt if the atomic pile will operate. The fuel probably needs re-refining by

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

this time. We'll take the elevator down."

They cut into the wall of the elevator shaft to the power cables and installed another small generator. The elevator took them to the Combat Control Center. The power room was next door. In the power room they connected one of the mule pack burdens, an allotropic iron generator, and then went back to the room containing the Combat Control Center.

"Turn on the screens and let's see if . . . yeah. We've got visitors already. Too bad they didn't land in Mayer A," Pete said. "The blasters would have given them a little surprise!"

"I wonder if the weapons here still work. They've unloaded four fighting units so far, and somehow I don't think that our one will be enough," Harv said. He flipped on a couple of WEAPON READY switches. The lights dimmed. He turned them off and the lights brightened again.

"Pete, go next door and connect in the other power supply," Harv said. "It looks like we're going to need it to charge the accumulators in these weapons."

"Sure it isn't just a short circuit?"

"No, I don't think a short could last long enough to draw the kind of power our generator is capable of putting out," Harv answered.

A minute later two spaceships landed in Mayer A. There was a long pause as the captains aboard looked around for signs of danger. Neither noticed that the mining blaster mounted on the crevasse bridge no longer pointed down into the hole it had cut to release Harv, but was now aimed in their general direction. Harv had informed the moon creeper, who was connected to the Combat Control Center via spy-ray relay, of the new development. The creeper moved the blaster as Harv directed. By now Harv was seated at one of the consoles, waiting. A hatch opened. The blaster turned with microscopic slowness toward the spacecraft.

"With these new transparent polycyclic screens you can't visually tell when the screens are down. Wait until they're committed by putting down the unloading ramp. O. K., here it comes! Hold it . . . Hold it . . . Hold . . . FIRE!!" Harv commanded of the creeper.

The mining blaster, which had been designed to punch a hole through one hundred feet of solid rock in ten seconds, lashed out with its incandescent beam at point-blank range. It cut through the propulsion section of the spacecraft with a fantastic display of pyrotechnics as molten metal, blown by hot gases, sprayed forth in a shower. In less than a second the spaceship had been transformed from a dangerous fighting machine to a crippled hull with part

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

of her crew dead or injured. The blaster whipped along the hull destroying its integral strength, and in another second was trained on the second spaceship. The screens of the second spaceship were still up. Nothing happened. The second mining blaster was trained on the spaceship, still nothing happened. A minute passed with the spaceship in the full fire of both blasters before it acted. A single hot beam reached out and destroyed first one, then the other of the blasters. Then it swept along the first spaceship, *melting it down until only slag remained!*

Harv watched the second spaceship as it moved up over the peak. "YOU . . . SLIMY . . . SNAKE!" he said angrily to himself. "I disabled that ship, and you destroyed it rather than chance that any of the survivors might talk."

Harv was very busy by the time Pete returned from connecting in the second allotropic iron generator. He had figured out how to operate the console in front of him. The central computer was providing data, displays, and suggestions in response to his moving light pen. "Our fighting unit is currently outnumbered eight to one," Harv reported. "I'm waiting for all of them to get into the mine field on the ramp. There!" Harv closed a switch which set the electromechanical triggers of the mines. Almost immediately one of the enemy's fighting units tripped the trigger of a mine. It didn't go off. Instead it waited as the mass of the unit moving over it increased. Then, when the mass started to decrease, it let go. The fighting unit was literally blown to bits as the shaped charge tore into it. Two of the fighting units moved off the ramp. The rest stopped. Harv activated another mine field, and a moment later both fighting units were blown up.

Pete sat down at a console, and after a moment's searching found the ON button. The console displayed the status of the atomic missile launch sites in the walls of the surrounding craters on the scope face. Pete moved to the next console. It was marked "Local Defenses—Mayer Major" and turned it on.

"Hey, did you know that there's a charge of explosive in the crater wall next to those spaceships out there?" Pete asked.

"Get rid of it!" Harv said. "Their fighting units are working their way through my mine field with their blasters!" He then hit another switch. Ports were blown open in the crater wall face, and a salvo of explosive-carrying rockets were launched at the oncoming fighting units. The electronically controlled blaster beams aboard the fighting units flicked from the ramp, where they were cutting a pathway through the mine field, and disintegrated the rockets.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Pete closed the switch. In the crater wall overlooking the spaceships a sheet of high explosive went off. The jolt of the shock wave rocked even the Combat Control Center over a mile away. A solid wall of rock erupted out against the shields of the spaceships lying on the floor of the crater. One of the four spaceships was still inertialess and somehow survived. To those who realized that something was happening it seemed as if the wall jumped out to meet them. The screens of the spaceships flashed briefly as they were overloaded by the sheer mass of matter smashing into them. The spaceships were crumpled, and then crushed under the tons of rock which came down on top of everything. A small cloud of dust hung over the spot where the spaceships were buried for almost a minute as the pieces of rock settled into new positions on top of what were now inert chunks of metal. The remaining five fighting units hesitated while the two surviving spaceships took over control, then they came on steadily.

Pete stood up and looked over the remaining battle consoles. Of the ten in the room, one bore the title "Local Defenses—Space and Internal." Pete moved.

"Copernicus Control wants to know what is happening over here," the moon creeper reported through the spy-ray relay.

"Tell them," answered Pete. He started turning on weapons and again the lights dimmed. "Damnation, those must be big weapons!"

"I've got four that are charged now, and four on charge," reported Harv.

"I've got four on charge," Pete reported. "Two inside the front entrance, and two covering the peak. What kind of weapons are they?"

Harv gave Pete a calculating look, but didn't say anything.

Pete caught it and stopped. "What are they?" he asked.

"Lasers."

Pete froze.

Lasers had gone out with the first Jovian War. They were inefficient wasters of energy. With the advent of multiplex projectors, which were so efficient because they could convert their own heat losses back into usable, or if you will, transmittable energy, lasers as weapons were abandoned. To be portable, an ultra powerful weapon required ultra efficiency. If you use 10^{20} watts of power in your 99.999% efficient weapon, how do you get rid of the 10^{15} watts of raw heat released inside your own ship in the insulation of a vacuum? No ship can use a really big laser, but a base on a planet or moon can, because it has a whole world to soak up the thermal losses. But once more efficient weapons were available, what base would want to go to the trouble of preparing and maintaining the paths for those thermal losses.

"We've had it," Pete said.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"I'm glad you realize that," a voice broke in. One of the spaceships had found the spy-ray relay and had tapped it to find the Combat Control Center. "I gather that you would like to surrender?"

"I saw what you did out there to your own people," Harv said.

"Surely . . ."

Pete slapped the switch of the spy-ray relay off with an angry gesture. "Have we got a chance?" he asked Harv.

"I don't know."

One of the spaceship captains had apparently had enough. They now knew where the Combat Control Center was, and he had decided to destroy it. The spaceship trained a blaster beam on the side of the crater wall and started cutting down through the material between it and the room where Pete and Harv waited. A plume of superheated rock vapor shot backward out of the hole and engulfed the outside of the spaceship's screens. Clouds of evaporated rock came out of the hole as the spaceship's ravening beam cut inward. Lava was streaming out of the sides of the hole like water.

Pete watched for a few moments, and then commented. "If he's going to try to dig us out by evaporating all the rock down to us, we've got about half an hour."

No sooner were the words out of his mouth than the spaceship put down three pressor beams to anchor itself, while with a tractor beam it bailed out the hole the blaster beams had dug.

"Five minutes, maybe," Pete said, revising his estimate.

A minute later Harv reported that all eight of his projectors were charged. "I can elevate four beams high enough to hit the southernmost spaceship. Now that he's moved, I can't bring any to bear on the one who's cutting in." The lights had brightened noticeably.

"I'll need another two minutes to finish charging my units," Pete reported. "Do we have it?"

"Yes, but not much more," Harv answered. He picked up the portable spy-ray unit to watch the progress of the hole being cut.

"It's three thousand feet away!"

"Two thousand!"

"A thousand!"

"Full up!" Pete shouted with relief. "Ready! Set! FIRE!!"

Above on the surface twelve concealed weapon ports slid back revealing the working ends of laser weapons fully ten feet in diameter. Below, the television screens went blank as high density filters covered the camera lenses. For a moment Harv and Pete thought something had gone wrong, or burned out. And then the lights flickered as the weapons came on.

These were no polite blaster beams radiating only a small portion of their controlled energy until they struck something. These were solid ten-foot beams of raging, raw light energy, searing their way

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

to their target. Even a television camera could not view them unaffected. Four beams caught a fighting unit just before it entered the cavern. Its screens flashed so rapidly as they went down that a human observer couldn't have separated them. The fighting unit was vaporized, as was the one behind it an instant later.

Six computer controlled laser beams, sharpened to daggers, hit the same point on the screens of the southernmost spaceship. Its outer screen flashed as it was overloaded by myriads of megawatts of visible, incandescent energy. As did the second layer—and the third. The wall shield held for almost two seconds as the full power supplies of the spacecraft energized it against the searing, visible energy for which it was not designed, and then it, too, failed and collapsed. Abruptly only droplets and vapor of the spacecraft were left as the beams fanned out.

Pete now turned his two external beams onto the remaining spacecraft, which had been cutting into the crater toward them. The outer screen of the spacecraft went down. By now the power being used to energize the spaceship's offensive efforts was being diverted into holding the screens. After a little delay the second screen turned opaque and then went down. But the third layer held.

"All done," Harv said, turning from mopping up the last fighting unit. "How's the spaceship? Oh!"

"I don't know how much longer these beams will last," Pete said.

"Put four more on charge . . ."

The spaceship disappeared.

"I guess he decided that he couldn't reduce us, so he went before we could bring more power to bear," Pete said.

"More likely enough heat energy was leaking through his shields that he couldn't stand it any longer."

The lights went out.

"Oh, oh! What did he do to us?"

"I don't know," Harv said, turning on his vacuum suit lights. "Let's check next door."

"We're out of iron. The generators must have used up their supply. That spaceship quit just in time," Harv reported. He picked up a small bar of iron in his gloved hand and dropped it into one of the hoppers. The lights came on, flickered, and went off. "You might turn off a couple of beams," Harv said to Pete. The next load of iron kept the lights on. Harv filled the generators, in case of emergency.

Back in the Combat Control Center after they had made arrangements for the newly victorious Galactic Patrol to take over the moon base, Harv turned to Pete, "All right, Ace. Now for some unfinished business," he said. "Where's that flask of brandy I ordered?"

This gave Pete a chance to display some of the new words he had learned from Harv. ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Rat Race

Computers are wonderful—utterly stupid, but reliable. They can't handle originality, though, nor unprogrammed problems, or creativity, so naturally those must be banned . . .

RAYMOND F. JONES

Kelly Freas

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The big run of HO model railroad activity began that summer, and George Sims-Howton was responsible for it. He had a penchant for old things like that and came across a description of HO model trains one day while browsing in the public archives. It was characteristic of George that he would go down there and finger the old volumes rather than make a computer search for subject matter in a fraction of the time.

"If I just want to find out what's there, how can I ask for it by subject?" he'd argue.

He brushed off the answer that he could use random search on the library computer. He said he liked to feel the old things with his hands.

There was no objection to it. Nobody else had asked for access to the original archives these past ten years. Actually, most of the stuff had been long since destroyed, because it was preserved on tape or film. Why it hadn't all gone that way worried no one.

Anyway, it was there, and it gave George a lot of pleasure to wade through the stuff, and that's how he came up with this model railroad thing. It seems there used to be whole magazines and books devoted to the subject about a hundred and fifty years ago, but it's almost certain that no one living had ever seen a model train until George came up with it.

Right away, George wanted an HO railroad, and the idea intrigued some of the other fellows who lived in the same condomin. They all belonged to the same *bali-putsch* team and had beat every other outfit in their league and in several leagues around. They were ripe for some new excitement when George made his discovery.

They debated about where to get the train. Sam Bowlerman was sure the proper place would be a sporting goods store. Dave Estes said an appliance store. But George was convinced that a hardware store would be the place, and since the idea was his, that was where they went.

There was a shopping center just across the mall from their condomin. George had obtained veri-copies of some plans in an old model-railroading magazine in the archives and brought them along. He sat in the small booth and fed the veri-copies of the model train plans to the scanner, while Sam and Dave stuck their heads in the door. George had the feeling the scanner gulped as it absorbed the strange image on the paper. But the order was not rejected, and presently, the light went out, the plans were returned, and a slip of printout paper reported: Manufacture—Oklahoma City. Delivery—two days.

Sam growled in disgust. "Why do you think they schedule a little order like that two thirds of the way across the country? It could have been made in Buffalo and we could have had it this afternoon."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Question not the wisdom of the computer," said Dave. "It provideth all. But that kills it for the rest of the day." He glanced at his watch. "Only eleven o'clock. How about a game after lunch?"

Sam shook his head. "You're getting stale from too much playing. Ellie wants to go for a ride. I'm going to take her to Rio this afternoon. We'll get back in time to see what the train looks like."

"I'm going back to the library," said George.

"Call us when it comes in," said Dave.

George wandered back to the library, but he didn't go in. He drove past the utility complex of nuclear-powered machinery that kept the community going. He remembered that once, about five years ago, he had actually seen a Workman performing some manual repairs on the power station. He could still recall the deep envy he had felt for the man's privileged position. There had been a time when he thought he might even have a chance in the annual quota of Workmen chosen from among the Citizens. But his community had been bypassed entirely in the last two quotas, and George no longer had any illusions about himself. He lacked the qualifications in the first place, and he was too old now—at twenty-seven—in the second place.

He'd spend the rest of his life playing *bali-putsch*, wandering from one continent to another in aimless visiting with others like himself, occasionally doing something vigorous—like a six-month sprint in the Antarctic. That would be it.

The trouble was, the others—most of them—weren't like him. They seemed to be thoroughly enjoying this Age of Abundance, which had reached its full-blown state about three-quarters of a century ago. But George felt himself steadily eaten by a sick discontent and dissatisfaction.

He wasn't even sure what he was discontented about, but the history and the artifacts of a century or two ago gave him the feeling that he belonged in some such age as that. Not in an age of assured luxury that demanded absolutely nothing of a man. George sometimes had the vague, anachronistic sense that he ought to be contributing. But he had no idea what he would contribute, nor to whom.

Thinking again of the little model trains, he felt an utterly irrational pleasure. He had read of the long-vanished rail carriers, both Diesel and steam, but he had never heard until now of the model trains, which men used to play with. He had the feeling that he had rediscovered some long hidden pleasure that men had not known for generations.

It made no sense at all.

The train—engine, to be exact—arrived on schedule. Paula was there

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

when it arrived and couldn't believe her eyes. It was a child's wheeled toy. George's tender caress of it frightened her.

"What in the world are you going to do with that thing?" she cried.

"Run it," he said, "when we get some track." He realized for the first time that they had forgotten to order track to go with it. "And some cars. I'm going to get some bright yellow and red reefers, some cattle cars, and some tankers."

He guessed they had been so excited about the whole thing that they'd forgotten all about cars. It really had been hard to believe they'd actually get the engine.

He held it now up to the light, letting his fingers touch the tiny, realistic rivets on the dull black body of the boiler. He gently turned the drivers and delighted in the motion of the rods and valve mechanism.

"I'm going over to show it to Sam and Dave," he said. "They'll love it."

"Then they must be as crazy as you are!" shouted Paula as he went out.

She didn't really mean it. She was just frightened. George was always doing such incredibly odd things. Why couldn't he just be satisfied with *bali-putsch* and long talks on philosophy in the condomin mall like the other men?

Sam and Dave thought it was great.

"How do we make it go?" asked Sam.

George was baffled. He remembered reading about motors and electric power packs. But he hadn't thought any more about them than he had about tracks or cars.

Dave had been poking around the insides of the engine. Finally he looked up with exasperation. "This isn't ever going to go. The idiot computer just didn't put a motor in it!"

In dismay, and without looking at the engine, George knew Dave was right. They had submitted plans showing the external structure of the engine, but there were no details of the motor. If the plans had even stated that one was required, the computer probably would have whomped up something to make it go. As it was, they had an empty shell.

But that could be remedied. "We can get a motor at the same time we order track and cars. There are lots of other things you can get, too —realistic landscapes, ancient towns. This is going to be more fun than *bali-putsch* ever was." He held the little engine up again. "Did you ever see anything as beautiful as that!"

George hunted for two days in the archives, trying to find plans for a motor, but these simply didn't appear. It finally dawned on him that the plans he did find were for making by hand the parts of the models that it was practical to make in

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

that way. Other items were factory built. This astonished him more than anything else he had discovered up to now. That such things could be handmade by the model engineers themselves—

They got a motor simply by telling the computer they needed one and referring to the previously submitted plans. The order was sent to Manchester, England, and brought back a realistic steam engine powered by a miniature nuclear-isotope core. A complete radio control was furnished.

George recognized that this was considerable of an anachronism, but it gave a more realistic performance than any of the electric motors he saw referred to. He let it go.

They ordered track by the quarter-mile. George installed it in the all-purpose room of his condomin over the protests of Paula. By the time it was up the group had grown to fifteen HO enthusiasts, and track layouts were being planned by at least four other members of the group. There was more excitement than the condomin had seen since it was built.

It was the men, of course. The women stood around on the fringes looking bewildered, wondering if their men had gone utterly insane. George, at his operating cab, wore coveralls, an engineer's long-billed cap, and a blue kerchief around his neck. With intoxicated enthusiasm he jerked the cord above his head and sent a wild, shrill whistle through the room. His 2-8-8-2 Mallet chuffed into motion with a long string of brilliant reefers, cattle cars, tankers, and a couple of Pullmans for good measure. He was vaguely aware that the passenger cars didn't belong with the others. But he'd work out the details later. For now, he had something going, the like of which the world had not seen for a century and a half.

In the freight yards, Sam was busy making up a freight that was due out in two hours, and Dave was putting together a passenger express near the station.

Assorted other members of the group were making up train orders, checking the accuracy of the present team of engineers, or waiting impatiently their turn at the controls.

The wives were near hysteria.

They met three times a week, at least. In between, there was incessant tinkering with the layout and the rolling stock. The local hardware store did a land office business in HO. Within a month it was agreed they simply had to have better facilities. A new wing was ordered for the recreation center at the south end of the mall. It was approved by the computer without a murmur. The parts were fabricated, and a couple of days later a Workman was sent out to erect the wing.

Normally, Citizens watched the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

erection of a building both with envy of the Workman and ghoulish anticipation. For occasionally—not often but occasionally—the computer controlling the job went awry with hilarious consequences in the form of an unholy mess. It had happened once in the condomin when a small eight-story medical building was going up. With six floors completed the thing simply shivered and fell apart. Two other Workmen had to come out to help program new tapes to get the site cleaned up.

But the model railroaders didn't want that to happen to their structure. They watched anxiously and gave the Workman all their silent good wishes for speedy success. He had it, and the huge room was ready for occupancy three days later.

They wanted to elect George president of the group, but he sidestepped that one and got Sam elected to the position. Sam was an organizer, captain of the *bali-putsch* team, and the most logical one for the position.

George wanted to do some thinking.

It would be more fun if they could do their own building of equipment. According to the old journals in the archives, that's the way the most advanced old-time modelers used to do it, and George could see why. What greater pleasure could there be than to take raw metal and shape one of these delicate engines out of it? It was a pleasure that no man in the Abundant Society could know—unless he was a Workman or an Artist. And George and his friends were neither.

The question of metal stock was something of a problem. He supposed the hardware store would be the right source and tried it. He ordered some sheet brass and copper and pot metal alloy.

His order was totally rejected.

He realized long after that this should have been a warning. But at the time he was too hell-bent to pay attention to storm signals. After an evening of intense concentration on the problem he came up with the solution of ordering various artifacts that had large quantities of the material he needed and cutting them up.

It worked. He got some large boilers of copper and brass, and some pots and ladles of the alloy.

But there was the matter of tools. George dug up all the descriptions he could find of cutters, drills, files, screwdrivers, and soldering tools. He had never seen any of these. Nobody in the condomin had. Probably they were used by Workmen, but he didn't know.

He wondered if he would be rejected on those.

He tried an order for tinsnips, showing the computer reader a picture from an ancient catalog. The snips came through.

He tried a screwdriver and got it.

One by one he ordered the hand

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

tools the journals indicated he'd need and he practiced shaping the stock he cut out of the tubs and boilers. It began to go quite easy, and he was drunk with the ecstasy of it.

There was one other thing it looked as if he'd need in the near future—a lathe. A three-inch swing and a sixteen-inch bed would be plenty big enough. But he couldn't find any complete plans, and it was too complex to derive from a picture alone. He began drawing his own plans. They were rough, but the computer could work it out from the specs he wrote alongside his drawings.

When he'd completed a sketch of the lathe bed he ordered it as a trial. It came back in a couple of days and was perfect. He followed with the other parts, the head, chuck, screw, tailstock. He let the computer supply its own specification for a nuclear-isotope motor. When the whole thing was finally assembled, George put a piece of ⅜-inch rod into the chuck and touched it with the tool. A thin spiral of steel curled up in bright beauty.

George's hands began to shake so he couldn't hold the tool any longer. He shut the motor off and sat down. The steel spiral lay on the bench now. He regarded it with wonder, and then looked down at his own hands.

The visitors came early the next morning. There were two of them. They greeted him pleasantly and asked to come in.

He knew everyone in the local condomin. He wondered who these strangers were. Then he glimpsed the small blue symbol on the breasts of their coats, and his knees began to tremble.

"Please sit down," he said. "Refreshments?"

"No," said the taller one. "It's early. You're George Sims-Howton, I believe?" He had a miniature writer on his knee and was punching buttons as he talked.

George licked his dry lips. He was glad Paula was out. "Yes. I'm on the championship *bali-putsch* team for this district," he added, irrelevantly.

His visitors were bright-looking young men. They weren't any older than he was, George thought. One was tall and one was short. Except for that, you could hardly tell them apart. The expressions on their faces were the same. Friendly, courteous, smiling—implacable.

"You have been ordering some unusual devices recently," the tall one said. "Some tools."

"Oh, yes!" said George warmly. "Would you like to see them . . . see what we're doing with them?"

Both visitors shook their heads.

"It was quite ingenious of you to order them one by one," said the tall one. "And the lathe—piece by piece. Very ingenious."

"I don't know what you're talking about."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"You certainly knew that if you had ordered all the hand tools at once, or the complete lathe, the order would have been rejected."

"No . . . I didn't know that. And I don't understand what this is all about. Will you please tell me?"

"I don't believe that you don't know. But for the sake of the record we'll go over it. Production. The accumulation of hand tools which you now have is a production facility. The lathe is a production tool."

"I suppose it is," said George. "I got them to build some model railroads. If you'd only let me show you—"

"What kind of production is unimportant. *All* private production is prohibited. You know that."

"Yes, of course I know that. But this is not *production*—it's just making some little trains. I—"

"The only reason our society exists today is that production is properly controlled. Since the beginning of man's history the world has been more than capable of providing all that men could consume. The only trouble mankind ever had was with systems of distribution and conflicting philosophies of creation and accumulation.

"It was all so very easy once we took man out of the picture and made of the problem only a matter of logics and control. So very easy —you want a toy train and the computer determines that it will fit into the overall matrix of construction and distribution and orders one built for you. The factory builds it. You receive. You give nothing in return, neither service nor what was once called money.

"The population next year will be 3.8 million greater than this year. The computer has already determined this, and the food for those extra bodies is in production. They will never starve. They will never want for any device or product they can conceive. The earth can provide for ten times the bodies it now supports. Would you upset that provision for abundance?"

"No . . . no, of course not! I still don't know what you are talking about. I just wanted to make a little train—"

"The computer will determine if the trains should be made, and it will direct the factories to make them. It will supply you with the wildest contraptions you can dream of. But *it* controls the production. Do you understand that?"

The other one spoke up now. "A little train here. In another condomin, a piece of fabric and simple clothes. Somewhere else a strange food or a new device. All over the world—and people begin to trade these things and value them because they are different. And control is lost. The computer does not know what products, what food, what clothes are needed tomorrow and next year. The Abundant Society breaks down."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The tall one nodded. "It is for this reason that production tools and equipment are prohibited. They are not needed; ask for anything your heart desires, and the Abundant Society will give it to you—free. But, more important, the Abundant Society exists in the face of human-controlled production."

George was aware that his breath had been stifled. He had known none of this; he had never cared to know it. These were things that were discussed by the would-be philosophers who sat in the sun in the mall and refused to join in the *hali-putsch* games.

But what was the penalty?

"You will return these tools through the distribution channels by which they came. Your condomin will be marked with a warning which must remain for the next sixty days. That is all. You must watch yourself carefully. Order that which you please. If it is approved, it will be received. But keep out of anything resembling production.

"We stop smiling on the second offense. There is no appeal. For a second offense the penalty is reduction to subsistence status for the rest of your life and removal to the subsistence reservation. Do you have any questions?"

George shook his head numbly and felt that he was still shaking it as he stood by the window, watching them go as their little car took off and flew high over the mall.

He went outside then and looked at the wall by the door. They had pasted a blue banner there that announced to the world and all his friends that George Sims-Howton had been given a subsistence-reservation warning.

He wondered what would happen to the model railroad group. He wondered if Paula would divorce him. He put on a light coat and left the condomin, walking through the mall, where he waved to the philosophers in the sun and answered a call from players on the *hali-putsch* court. He continued on through the parklike fields and woods beyond the community.

On the top of a small hill he stopped and looked back. A paradise, and he was a snake in it, he thought; somewhere he'd heard of an allusion to something like that. But what kind of a paradise was it that could be threatened by a model train?

He sat down and began to think about that. Somewhere here was a problem, but he couldn't define it; he could only feel it. He had felt it all his life, he thought. That vague discontent that had always plagued him. He remembered how it had vanished when he watched the bright shining spirals curl up from the stock in his lathe.

It must be as simple as that, he thought after a while. That was the missing element of the Abundant Society. And if that were so, what a mockery the name was. It was not

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

abundant; it was the most impoverished of all imaginable societies. A man's supreme joy was the joy of building, molding, changing, assembling—creating—with his own two hands and his mind. And this was the single thing the Abundant Society could not tolerate for fear of coming apart at the seams. Only a narrow elite, isolated from all other citizens, could be permitted the luxury of creation—of work.

He'd have to do something about that, George Sims-Howton thought again after a long while. He had an idea that maybe there was something he could do about it. Maybe the notion that he should be contributing, which had plagued him ever since he became an adult, was not so crazy, after all.

When he got near home he saw that small groups of his neighbors were still standing around his doorway, looking at the blue banner. Nothing like it had ever happened in the condomin before. He didn't know how they would react. He didn't know how he should act, himself.

As it turned out, things were better than he expected. He explained the situation about fifty different times before the day was out, and everyone was sympathetic and understanding. He wasn't marked as a Jonah, to be run out of the condomin by ostracizing.

There was only Paula. She didn't understand. She was frightened. There was nothing he could say to explain away her fears. And then he remembered that she had seen in her childhood someone who had been sent away to the subsistence reservation for some crime. The talk of the adults at that time had burned itself into her mind: ". . . No shelter except what they build themselves; only half enough food to keep alive; heat from open fires; no protection in the summer . . ."

"You'll give up all this crazy toy railroad business, now, won't you?" Paula begged.

"They didn't ask me to do that," George said. "It was the tools, and I'm going to take them back. I made a mistake, and I won't make it again, because they told me where I was wrong."

Paula didn't understand. She couldn't separate it from the trains.

George remained awake most of the night. He had no reason to doubt that the terrors of the subsistence reservation as remembered by Paula from conversations overheard in childhood were less than real. He had heard some of them himself. But he had never seen anyone who knew firsthand. No one ever returned.

He would be risking it, he knew, if he tempted the powers of the Abundant Society any further. He did not know the details of the law. Citizens were not taught those things. Somewhere in the upper echelons of the Workers who governed by, for, and with the mam-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

moth, world-wide computer system there were those who knew the law and passed it down to bright young men like those who had visited him today. He wondered how it was that so many of them escaped entanglement with the law when they knew so little about it.

But that was not the problem. Should he go on or not? Was there anything worth while that one man, by himself, could accomplish? The system had existed for a century and a half. It would go on for centuries more. Who was he to challenge it?

And risk a life sentence to subsistence reservation?

He went to the railroad room of the recreation center the next morning. He was the only one there. That night was the regular meeting. Only about half the usual number came around. George put on his coveralls and his kerchief and his long-billed cap, and he jerked the whistle cord with abandon. But it was no good. It was like a pall of dread had settled over the whole operation. They listened to George's explanations all over again, but they were afraid. *Baliputsch* was safe. The HO trains seemed like a fearful unknown, now.

He made his decision after the meeting. If he failed to go ahead now, the whole project would die.

He went to the hardware store the next morning with a complex order. It took him half the day to feed it in. And then he went out and sat in the sun.

Two days later a sizable shipment came in. He took it to the empty railroad room and spread it out. Thousands of parts, precisely labeled and packaged, just as he had ordered. That gave him some small comfort. If the order were illegal, the computer surely would not have approved and delivered it.

He began gathering the parts and repackaging them. He had even ordered brightly colored boxes to put them in, just like the ones he had seen in the old journals. Kits, they called them there. You could get all the parts and just put them together yourself—with the help of one small screwdriver. George had ordered the screwdrivers and put one in each kit.

Was it production?

He'd soon find out.

He presented the first one to Sam. Sam saw the box cover and shook his head. "I think I'm going to give it up, George," he said. "My game's been lousy since I started fooling with the trains, and I've got to get it back. I really think you ought to do the same. We're never going to have a chance against Monmouth unless we get back in shape."

"Open it up," said George.

Sam hesitated, then removed the cover. "What the devil?"

"A kit," said George. "You have all the fun of putting it together

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

yourself—and you get around the anti-production law at the same time."

Sam looked up cautiously. "You're sure this is all right?"

"Absolutely clean. The computer put the order through without a murmur. If it hadn't been right it would have been bounced, wouldn't it?"

"I don't know. You almost got clobbered for the tools, and the computer sent them through all right—and then tattled."

"It's safe," George repeated.

Sam couldn't help lifting out the delicate parts and touching them. His eyes were bright as he speculated on how they fit together. He tried the cab against the boiler casting.

"Here's the instruction sheet," said George. "I had it printed up to go along with the kits."

It was nearly midnight when he finally got the engine assembled, a beautiful little 2-8-2 Mikado. Sam's eyes were bleary with the unaccustomed close work. But there was serenity and joy in his face. "Boy, isn't she a beauty!" he exclaimed. "But say, I ought to give you something for this; you can't just give them away."

"Why not? They were given to me."

"You went to all the trouble of ordering them. And you packed the parts into kits."

"O.K. You pay me two blue chips. That'll square us."

Sam nodded and handed over a couple of the worthless chips that were used to bet on the *bali-putsch* games. "It's a deal," he said.

They were at the railroad room almost by sunrise to break in the new Mikado and check it out. By mid-morning George had disposed of fifteen more of the kits. Nobody moved from the room. If they couldn't find table space, they sat down on the floor and began assembling them. Most wanted engines of their own, to start with. But some began work on bright reefers or complex specialty cars, such as wreckers or hoppers.

At noon George leaned back and began to breathe easy. He had it going again. Most of the old group was there, and a couple of new fellows had dropped by to see what was going on and had got hooked by the fascination of assembling the kits.

George wondered, with a sigh of anxiety, how much time he had. Certainly the report of his order had gone through to a desk at some upper echelon. They had their eye on him. Or perhaps the computer had already ticked him off as a two-time loser.

It was five days before they showed up again. The same two. The tall one and the short one, with the same implacable faces.

George took them to the recreation center, into the new model railroad wing. A half dozen engi-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

neer's cabs were occupied on the huge layout. Eight or ten men were at worktables, assembling new models. They all stopped their work and blanched at the sight of the two men with George Sims-Howton. George had tricked them. Now they were all in for it!

George sensed their reaction. "Just a check," he said as calmly as he could. "On me—not you."

The two investigators conferred together with some uncertainty. "You put together the parts ordered from the hardware computer," said the tall one to George. "You put them together with a screwdriver into their finished form."

"That is right," said George.

"Why?"

"We like to. It's fun. Why do we play *bali-putsch?* It gives us pleasure. So does assembling the kits."

"The object is to run them around the track, is it not? Then why is it not more efficient and more pleasurable to order them in completed form? You could run them that much sooner."

George felt his hand beginning to go sweaty. "Both forms of activity give us pleasure. Who is to say it makes sense? *Bali-putsch* doesn't make sense when you try to rationalize it."

"But you are assuming for yourselves a part of the production process, which would normally be completed at the factory."

"No, no—" said George. "Production is the creation of something that has not existed before. These parts—they are already in existence. Their purpose is to form an engine or a car. We only carry out that purpose. Forgive me if I argue the point, for I realize that if I have made a mistake again it is a fatal mistake for me. But I do not think I have made a mistake. I have very carefully observed the law."

"It is our opinion," said the tall one coldly, "that you are very carefully trying to break the law. But we fail to understand why or how. I think the computer will be able to clarify these matters. We will return as soon as we have its analysis and its decision."

George wandered out into the sunshine of the mall after they were gone. The model railroaders were uneasy. Some of them had slipped out as quietly as possible while the investigators were in the recreation hall. Maybe even if the decision were favorable too much damage would have been done. No one had ever seen investigators around the condomin before. The most casual visit was terrifying.

And a third one was coming this afternoon.

He sat down at a distance from the groups of arguing philosophers lounging in the sun. He looked about the peaceful landscape, the aesthetically satisfying structures. Total lack of want, he thought, except for the one thing—the delight of individual creation. Without that, everything else was an empty

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

shell. He had felt it all his life. The driving discontent. The vague compulsion to take things in his own hands, to feel and shape them.

Maybe it was stronger in him than in the others. But they felt it, too. Their pleasure in the little trains was proof of that. And that pleasure would stir and ferment if only it could be nurtured with a little care.

He had risked all he had here, against the unknown terrors of subsistence reservation, to provide that care. It was all he could do. It was what he had to do.

The sun was low and shadows were lengthening when they returned. They were walking slowly as they approached, and their faces were more puzzled than ever.

"The computer cleared you," the tall one said. "It pronounced your activities nonproductive and legal."

"Thanks," said George.

"Don't thank us. We merely carry the message. You are going to be watched. Everything you do will be evaluated by the computer for conformance to the intent of the law. An automatic alarm will indicate when you slip. We're with you night and day, George Sims-Howton."

He was all alone in the mall when he finally got up to go. It was dark except for the moonlight and the glow from the buildings. He could see lights in the railroad room. Some of them—it looked like quite a number—were gathering for the evening run.

Hundreds would learn what it meant to put something together with their own hands. They would learn the pleasure of touching materials that were fine and delicate and smooth and well-formed—the pleasure of forming and shaping and putting together.

A few hundred, maybe. It wasn't much, but it would spread. And then someone would take the supreme risk of going out in a forlorn countryside and picking up rocks and putting together a house. And struggling for his own food right from the ground itself—for the mere pleasure of it.

Would he have to convince Paula it was not insane?

He thought of the computer. The idiot computer. It gave out only what was put in—plus an illusion of great omniscience. It could not distinguish between mechanical production and creative pleasure because those who had built it understood no such distinction. He was safe until greater men touched the computer.

But for now there were many things to do. More trains to put in kits. And he'd just learned about model airplanes, and animals and people, too. The field seemed endless.

It was just a question of how far he could go with it.

He had a feeling he was going a long way. ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The easy way out

Whether you call it Economics or The Law of Least Effort makes no difference—but for living organisms, from interstellar cultures to vicious animals—it works!

BY LEE CORREY

They came out of space armed and ready.

The alien ship skittered into the Earth's atmosphere in an easterly direction and landed surreptitiously about midnight in the Rocky Mountains of North America. The Master had chosen the approach trajectory and landing area after a long survey in far orbit.

"Whew!" Ulmnarrgh breathed with relief as the ship's sensors reported no great hubbub created by the silent landing in the meadow among the high peaks. "I don't think we were detected. There were no probing emissions in the electromagnetic spectrum and no phasing of the gravitoinertial field."

"Keep your guard detectors up," the Master directed. "We'll wait for daylight. In the meantime, run out the screens and keep all defenses on the alert."

Harmarrght fidgeted. "By the Great Overlord!" he snapped under his breath to his mentor, the exobiologist Norvallk. "The Old Boy acts as though he's scared to death."

Turning an eye toward the youngster, Norvallk gently replied, "Don't cover up your nervousness with bravado. All of us remember how we felt on our first landing as a cadet. A certain amount of caution is always indicated, particularly in the face of the fact that the previous probe ship didn't come back from this world."

"The only logical reason for that is a technical malfunction," the youngster shot back.

The exobiologist shook his head sadly. "Logical answers don't always hold true in exploration. This planet's inhabited by communicating beings. If you're going to insist on using logic, calculate the conclusion you get when you take into ac-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

count the loss of a ship on a planet whose inhabitants have an unknown level of technology. Mukch on that for a while!"

Harmarrght didn't. He had an immediate answer. "I've studied the history of our conquests for the Great Overlord, and nowhere on a thousand worlds has our high technology been equalled. *That*, sir, is an established fact! So now we crawl in here with pseudopods rolled up like a frightened orh. Why should we be so cautious when our technology makes conquest so simple?"

"You're here to learn why," Norvallk told him. "So shut up and observe. You've been trained; now you're about to be educated . . ." These young cubs just out of the Institute were always impetuous, he reminded himself. Such attitudes made excellent warriors for the Great Overlord, but when were the professional institutes going to learn to temper their indoctrination when training explorers?

The Master called for a confrontation in the control bay. This was a welcome relief to Norvallk who, as the chief exobiologist aboard, had nothing to do but sit and shiver until he could get out and have a look at things.

"Our position here, while secure at the moment, may be perilous," the Master pointed out to his crew. "I want to impress again on you the complete nature of the situation. You have all seen the reconnaissance images from the first orbiting probes that revealed the unmistakable sign of intelligent life: deliberate conversion of natural resources into more orderly features such as artificial waterways and geometrical groupings of artificial dwellings.

"It's unusual to find a planet inhabited by intelligent life. But this planet appears to be unique in that it seems to support more than one type of intelligent life.

"Communication is by means of electromagnetic radiation. There is no way of knowing at this time whether this is a naturally evolved trait, such as we found on Vagarragh Four, or the technically developed artificial extension of pressure wave communication such as we have. Rastharrh, tell us what you have discovered."

The information theory expert was somewhat hesitant. "I don't quite know what to make of it. There's more than one coding group involved. I've even run onto a highly unusual code group consisting completely of periodic transmissions of a carrier, and this may be highly indicative of a life form here that communicates by electromagnetic means. It's difficult to conceive of any planetwide intelligent life form that uses more than one type of communication symbol code. Here, there are many. It leads me to believe that this planet may have evolved several high life forms, each communicating differently."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

John Schoenherr

The Easy Way Out

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Norvallk, is this possible?" the Master asked.

Norvallk shrugged. "Anything is possible when dealing with intelligent, communicating beings. The physical arrangement of the planet's land areas suggests that Rastharrh's hypothesis may be correct. I wouldn't discount it. We have got to have a first-hand look."

"And that's what we're going to get." The Master gave his orders.

There was barely enough time to accomplish anything before the sun rose. The planet had a very short rotational period.

It was not a bad-looking world, Norvallk decided as he surveyed the landing site. He pointed out several features to Harmarrght. "Frozen water over there on those high peaks. And note the abundant inverted life forms growing stationary on the hills. If they are at all like the ones on Chinarrghk, they have their brains in the ground and their energy receptors above ground. And probably immobile as well . . ."

"No problem to overcome them if they can't move," Harmarrght stated flatly.

"That depends upon their biological operation and natural defenses, youngster. They could exude poisonous gases when disturbed, for example."

"We can handle that."

"Once we know about it."

"There is no obvious reason why we can't take over this planet for the Great Overlord."

"There may be several reasons why we can't. It all depends on the native life forms, particularly with regard to their Intelligence Index, Adaptability Index, and, most important, Ferocity Index."

"Oh, come now! If they're incapable of defending themselves against our advanced technology, they don't stand a chance!"

Norvallk did not answer his protégé. Lecturing no longer was effective.

It was nearly midday by the time the ground party was organized to leave the ship. Norvallk led it, supported by Rastharrh, the morphologist Grahhgh, three well-trained and experienced recording specialists, the three warrior techs. The whole party was armed with both energy weapons and projectile hurlers. Harmarrght accompanied Norvallk as his direct assistant.

The ten aliens proceeded down the slope from the meadow into the valley. There was a stream on the valley floor and a chance of encountering advanced life forms.

"There are life forms everywhere!" Harmarrght remarked.

"And they take many shapes, but they don't bother us. We'll have to set automatic traps for those flying forms; they're much too fast," Norvallk observed.

They did not reach the stream until well after sunset, but the light shed by the world's natural satellite

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

permitted the party to find its way and continue to record some data.

At sunrise, they found the grizzly bear.

"Let's take it back to the ship!" was Harmarrght's first excited comment.

"Not so fast!" Norvallk cautioned. "We watch first. Quietly. It's feeding. Look how it reaches down into the water and knocks those water-dwellers out onto the bank."

"By the Great Overlord! It's *fast*!"

"Let's see if the Master can find some counterpart from a known world." Norvallk instructed the data recorders to beam their images back to the ship. In a quick communication with the Master, Norvallk set up the search through the memory banks of the ship's computer. As he was waiting for the answer, he gave a little instruction to Harmarrght. "Notice the covering of organic filaments that may either be manipulators, sensors, or thermal insulation. And the grouping of sensory transducers around the food intake orifice."

"It carries no weapons," Harmarrght pointed out.

"It may not need them. But note the plurality of sharp artifacts on the end of each appendage. Are you willing to state unequivocally that they are not artificial?"

A message came from the ship. Zero readout from the memory bank. Plus the Master's direct order, "Bring the life form in for study, preferably functioning."

With obvious relish, Harmarrght hefted his energy projector and started forward. Norvallk tried to stop him, but it was too late.

Very few native life forms will bother a feeding grizzly bear. *Ursus horribilis* is not only strong, but easily provoked. But Harmarrght didn't know this. He found out quickly.

He fired an energy bolt at what should have been an area of vital control in the bear's midsection with the intent to paralyze the beast. The shot singed white-tipped hair and burned a hole through the skin. It hurt the bear and drew its attention to the young alien.

"Cover him!" Norvallk yelled to his party. One of the warrior techs burst forward to get between Harmarrght and the bear.

The bear stopped fishing and let out a bellowing roar. This panicked the warrior tech who fired a projectile toward the bear's head. Another of the warrior techs got into position. But the bear moved . . . fast.

The grizzly brought its huge forepaw down on the closest warrior alien. Armor and all, the warrior splattered.

The next swipe of the huge paw demolished Grahhgh, who had the misfortune to get within range. While trying to get to the second warrior, the bear stepped on Rastharrh, putting part of him out of

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

commission. The bear rose on its hind legs to its full height of eight feet and started to swing again, aiming toward Harmarrght, but the second warrior fired an explosive bolt that caught the grizzly in the roof of the mouth and congealed its brain.

It took a little time for Norvallk to get things straightened out again. As the four transports came from the ship to pick up the dead and injured, he whirled on Harmarrght, managed to suppress his anger, and said sarcastically, "So. It had no weapons, eh? Evidence of a low technology, huh? I thought that you had studied bio-engineering. . ."

The young cadet could only remark, "Its Ferocity Index must be unreasonably high . . ."

Three more transports had to be sent from the ship to lift the grizzly's carcass. The party then resumed its course down the stream, minus three of its members. "Standing orders," Norvallk told them. "We take no further action against indigenous life forms except when attacked. We'll merely observe and record data. It seems that most of the other life forms have a very low Ferocity Index, but I am not going to take the chance of losing the rest of this party."

Harmarrght said nothing; he was now reasonably subdued.

Two sunrises later, the party discovered another silvertip grizzly. The aliens didn't repeat their first mistake; they stood well back and watched this bear carefully.

It was leisurely dining on the remains of a freshly-killed white-tail deer at the edge of a small clearing alongside the stream. Apparently wanting a bit of variety in its diet, the bear had managed to find an easy mark in an unsuspecting young deer.

"I am beginning to suspect that the Ferocity Index of this life form is a little bit too high for comfort," Norvallk observed.

"But still nothing that we can't overcome with our existing weapons," Harmarrght added.

"There are many other things yet to consider," his mentor told him. "Observe and remember."

While they were watching the second grizzly dine, a report came in from the ship. "The dead beast has been given a preliminary examination. Its colloidal control network is very complex and contains a highly organized colloidal computer near its primary sensors. It has the capability of a very high Intelligence Index," the Master told them.

Norvallk hastily briefed the Master on their current find and added, "We see no signs of artifacts associated with the beast unless those sharp instruments on its appendages are tools."

"They aren't. They are natural."

"In that event, it isn't using tools. I don't know whether or not it's communicating right now. Too bad

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Rastharrh was injured; we could use him. A new life form has just arrived! It's smaller but covered with the same sort of organic filaments. Same configuration. It's going right up to the larger beast. We may be witnessing our first example of symbiosis on this world where the large beast does the hunting and shares the meal with a smaller communicating form."

The bear looked up from its meal and recognized the small bear-like form with its broad ribbon of light brown fur down each side. But the bear was still young and still hungry; it decided to put up a defense of its meal. It had yet to learn that there are few animals of any size willing to tangle with *Gulo luscus,* the wolverine.

The wolverine simply attacked the bear as though it did not know the meaning of fear. Its flashing teeth and slashing claws were smaller and less strong than the bear's, but sheer meanness was on its side. It ripped in to kill, giving no quarter. After the first encounter in which the bear's huge paw missed in a roundhouse swing, the battle was very short and very one-sided.

The grizzly took the easy way out. It retreated, ambling off into the pine forest as rapidly as it could move.

Norvallk was shaken, but Harmarrght was now petrified. "Let me kill it!" the youngster urged.

"No. You may not be able to," Norvallk stayed him.

"It will be easy!" He hefted his energy projector and patted it.

"We tried that once. Three of us for one of them. And the Ferocity Index of this little animal is going to be very difficult to compute. It's high. Let's see what the Master's computer says." Norvallk fed all of the available data back to the ship.

The computer chewed on the available data regarding size, probable body mass, and other related factors of the two different animals, bear and wolverine; it then compared this with data from other worlds, considered the possibility of reducing the high Ferocity Index of the bear, found that it could not logically do so, discovered that it could not handle the Ferocity Index of the wolverine, and ended up in a stoppage. The wolverine's Ferocity Index was off-scale.

In the meantime, Norvallk and his group kept observing and reporting. "It's cleaning up what's left of the carcass, and it acts as though it hasn't eaten for days. It's simply glutting itself."

"Its Ferocity Index may diminish when its hunger drive is satiated," Harmarrght ventured to predict.

"In any case, it can't finish that carcass, and we'll be able to take it back to the ship for analysis."

"Ugh! I wonder." Harmarrght remarked, reeling from the odor that now wafted in their direction.

"It's fouling the remains of the carcass with musk!" Norvallk ob-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

served in amazement and almost gagged.

The wolverine, being unable to finish, had simply protected what was left so that he could return to complete the meal at a later date. It then sat up on its haunches, shaded its eyes with a forepaw, and looked around.

The alien party worked very hard at remaining unseen and unheard, although most of them were gasping as a result of the horrible smell.

"Did you say something about technology earlier?" Norvallk managed to ask his student between stifled coughs.

The wolverine found its direction again and ambled off.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Do we follow?" Harmarrght asked. "Or do we stay here and suffocate?"

"Let's go! Keep it in sight, but *don't* let it detect you," Norvallk ordered his party. He had no desire to tangle with this little beast. But he had to find out more about it.

As they went along, Norvallk asked Harmarrght, "Do you still think that this world would be easy to conquer?"

"Well . . . Nothing so far that our weapons couldn't cope with. It might be expensive and it might take time, but we could do it . . . if what we've seen is any indication. They're tough, but we're just as tough and just as well-armed."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Wouldn't you say that this being has a reasonably high Ferocity Index?"

"Yes." Harmarrght admitted.

"Which means we would have to kill them all or subdue them. From the looks of them, we'd probably have to kill them. But suppose we don't get them all. Would you like to live here knowing that one of those things was on the loose?"

"If I'm armed and expecting it, why not?"

"What did you learn at the Institute?" Norvallk exploded. "Didn't they teach you anything about the economics of conquest and exploitation? Didn't they teach you how to evaluate the Indices?"

"Well, yes, but . . ."

"Did you ever stop to consider the difficulties of conquering a world whose inhabitants have low Intelligence Index, low Adaptability Index, low Technical Index, but high Ferocity Index? Under those circumstances, a takeover becomes a disaster if the natives fight to the death with no quarter given! *Successful* colonization requires that the native life not only be overcome, but also be re-trained and made suitable to work under the direction of the colonizers. You can't spend all your time fighting. Now that you're on a new planet for the first time, maybe you'll realize that a planet is a big chunk of real estate. You *can't* wipe out every dangerous animal on it, but if they're too dangerous you *must* dispatch them lest they continue to breed and remain a constant threat. Under a situation like that, you have to withdraw from the planet and write it off."

"Retreat? But we've never had to do that! We've *never* written-off a world!" Harmarrght objected.

"We'd have written off a dozen of them if we'd known then what we know now. Those worlds were very expensive acquisitions," Norvallk reminded him as they moved along, keeping the wolverine in sight but not permitting their conversation to betray their presence. "You were filled with propaganda about the glorious exploits of those who did the dirty work. It looks different when you've been on the scene. Or it should. What is your evaluation of this world thus far? Apply what you've been taught. You can even use logic if you want."

"Thus far, we've discovered two life forms with high Ferocity Index," Harmarrght said by way of review and lead-in. "But they evidenced no obvious Communications Index, a moderate Intelligence Index, and a very low Technology Index . . ."

"I'm not willing to concede that point yet," Norvallk put in. "But go on."

"*Ergo*, the dominant species might not have a high Ferocity Index, being dependent upon symbiosis with other species to acquire this factor. I make the presump-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

tion that Ferocity Index would logically have to be lower in more intelligent, communicating beings than . . ."

"An assumption without adequate evidence," Norvallk pointed out.

"Well, on the other hand, the two forms already discovered might not be the dominant species on the planet. They might simply co-exist with the dominant form."

"Suppose the dominant form has a higher Ferocity Index," Norvallk said.

"Oh, quite unlikely! We've *never* encountered anything before with the fantastic Ferocity Index that would be required!"

"Harmarrght, it's a big universe."

"Yes, but very few planets exist with the physical characteristics of this one. It seems to me that the Overlord might be unhappy with a recommendation to abandon it now that . . ."

"Which means that we must gather as much data as we can." Norvallk indicated the wolverine. "Watch! The animal is hunting something new."

By climbing a tree, the wolverine finished off a squirrel. Very shortly thereafter, a porcupine managed to get out of its way. The wolverine then proceeded to catch a rabbit and a chipmunk, but it befouled them and cached them instead of eating them.

"Well, we seem to have stumbled on the beast that probably has the highest Ferocity Index in this neighborhood," Norvallk commented, then stopped in his tracks as the wolverine emerged into a clearing.

"A dwelling!" Harmarrght exclaimed. "If it belongs to this beast, it indicates a much higher Intelligence Index than I expected for it. Look: smoke comes from a vent on the roof, indicating a mastery of the chemical combustion process which . . ."

"Don't assume that it belongs to the animal," Norvallk cut in and pointed out the tools scattered here and there around the cabin and the plot of ground that was a garden. "It couldn't possibly handle tools of that size. It's demonstrably a hunter, and I wouldn't expect it to be a farmer, too." He snapped orders to his exploring party. Quietly, the various specialists ranged themselves in hiding around the clearing so that their recorders had a view of the cabin from several sides. The warriors were given strict orders not to use their weapons except in defense of the party.

The wolverine prowled around the cabin for some time. Norvallk waited patiently, but Harmarrght fidgeted nervously. "Let me go up and see what's inside that dwelling," he finally suggested.

"Not while I'm in charge of the party," Norvallk said. "This is an exploration crew, not a military group. I equate such bravery to stupidity at this point. I do not want to

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

have to return your remains to the ship . . . providing that the animal left any remains or that we could get to you afterwards."

"But one bolt from this projector . . ."

"How many others might be inside that dwelling?" Norvallk posed the rhetorical question to his student.

There was a movement behind one of the windows. Then, as Norvallk came up on the alert, two human children dashed out of the cabin with yells of delight.

With great consternation, Norvallk watched these two new life forms run fearlessly up to the wolverine.

"Glutton! You're back!" one of them cried.

They dropped to the ground in front of the little animal and began to stroke its coat. The wolverine responded playfully, for it had known these children all its life. They had found it as a cub, half-frozen and starved, somehow separated from its mother. Although these children had raised it as a pet, it often reverted to feral state and disappeared into the hills for days. But it always came back. Hunting was difficult and dangerous; it was far easier to be fed on schedule by the children. And the humans were capable of giving it something very pleasurable and desirable: love.

Glutton, the wolverine, rolled on its back and permitted great indignities to be taken. One of the children ran into the house and returned with some meat in a dish—and was disappointed when the wolverine refused it. But Glutton did not befoul this meal as it had done with others it could not eat.

The young bipeds talked to it, played with it, and fondled it for some time. The aliens recorded every movement and sound. Norvallk was very busy trying to make things add up in his mind; he was quite unhappy with the conclusions he was reaching. Harmarrght merely watched in great confusion; he was having great difficulty rationalizing what his own logic told him with what he had been taught.

A larger biped appeared in the cabin door. "Boys! Lunch time! Come in now!"

They started to go, but the wolverine wanted more play and love. It growled and tried to nip at one boy's leg.

The human child turned around and cuffed the wolverine smartly, scolding it as he did so.

The wolverine shook its fur and followed the boys into the cabin.

Norvallk wasted no time regrouping his party and getting them back to the ship.

"You've done an excellent job under most hazardous conditions," the Master told Norvallk and the rest of the party. "Your data confirms the conclusion we've already reached here. Ulmnarrgh has received radiations from life forms

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

that are orbiting this world as well as in transit to nearby planets. The varied inhabitants of this world are already out in space and expanding with explosive speed. I will be recommending rather drastic measures to the Overlord. In the meantime, we raise ship at once and try to get out of here without being destroyed."

As the ship boosted away under maximum drive, Norvallk sat reviewing the data with his student. "It should be perfectly obvious to you at this point that the standard method of evaluating Ferocity Index and integrating the various Indices are useless for this planet. Tell me, have you ever run an exercise with data like this?"

"Well . . . no," Harmarrght admitted. "But this is a very slim amount of data taken in a restricted locality. I will admit that the planet is dangerous . . ."

"It's the most dangerous planet I know of."

"Well . . . yes. Even our most difficult conquests involved life forms with Ferocity Indices that we could at least measure. But the drastic measures the Master spoke of might certainly . . ."

"Forgive me for anticipating you," Norvallk broke in, "but those drastic recommendations are likely to involve re-routing of ship lanes away from this vicinity and perhaps even abandonment of nearby outposts."

"But we could certainly overcome . . ."

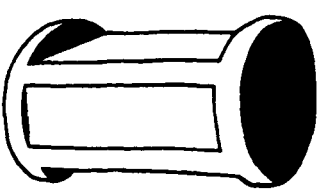
"Again, my apologies. Do you think we could fight the several life forms we saw on that planet without expending millions of warriors and a great deal of equipment? Remember the universal law of living organisms: the Law of Least Effort. This is a big galaxy, and there are more comfortable and less expensive parts of it in which to operate."

"I guess you're right," Harmarrght admitted. "There are easier things to do."

Back on the planet, the wolverine, although it didn't consciously know the Law of Least Effort, responded to it, too. It curled up on the rug in front of the fireplace and snoozed while beings with a higher Ferocity Index quietly ate their lunch around a table. ■

Why Engineers Use Three Views

This is the perspective on the object shown in the top and front views last month. (If you missed it—too bad.) It's a simple solid cylinder with four milled flats. This engineer's headache was contributed by K. D. Paul.



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The history of science is replete with outrageous hypotheses. They are mostly forgotten, as best they should be. But from time to time one of them proves to be true. So it was with the concept that the earth is round and that it spins in space supported by nothing at all. Now it seems to be so with the hypothesis that the continents of the world are fragments of two former super-continents, Laurasia and Gondwana, which first rifted apart possibly 150 million years ago, forming the modern continents which then *drifted* to their present positions. At least ferment has replaced the former low ebb of scientific interest in this concept. The evidence is not all in, and there is not even a favoring consensus of opinion; but there is a strong nucleus of advocates who are rapidly augmenting their number. I count myself among these. As a fairly recent convert, I tend to be more zealous than the old believers. I seek other converts. Perhaps even *you* can be "piped aboard" the drifting continents.

In the history of the continental drift theory, two names stand out: Alfred Wegener of Vienna, who in 1912 first formalized the theory, and Alexander Du Toit of South Africa, who in the Thirties fleshed out the concept with much geologic evidence. It has been the southern hemisphere geologists who seem traditionally to have found the evidence for drift most compelling, while those in North America and Europe have tended

*The views expressed here are the author's private opinions and they should not be construed to necessarily reflect those of the U.S. Coast and Geodetic Survey, with which the author is affiliated, or any other Government agency.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

One thing that seems to set our planet apart from the only other two worlds we've had even a somewhat close look at—Moon and Mars—is the dynamic nature of the immense mass of the planet itself. Life forms had to be adaptable on Earth; if they didn't move, the continents themselves did!

DR. ROBERT S. DIETZ

to treat it with a smile. Wegener's overstatement of the evidence unfortunately made it easy to do this. With him continental drift was a creed to be defended at all costs. Using a formula of his own devising, he once announced that the westward drift of the Americas was favored by a probability ratio of 1,000,000 to 1. But one of his "controls" for this amusing calculation was the matching of the Ice Age glacial moraines on opposite sides of the North Atlantic. Aside from the fact that such rough matching is to be expected from present day similar climates, this would time the splitting apart as only a few moments ago, geologically speaking—even the most ardent drifter can hardly subscribe to such recent separation.

Until a decade ago, most scientists were inclined to dismiss all drifters with disdain as biased zealots. Mere mention of drifting continents could provoke scathing remarks and one eminent geologist was said to have been rendered incoherent for days. Another geologist published a discussion of the subject in the *American Journal of Science* and entitled it *"Eim Marchen"* ("A Fairy Tale"), an expression generally reserved for other than scientific literature. He went so far as to suggest that the hypothesis be abandoned, in effect outlawed, so as not to obstruct the progress of science.

The results of modern studies in paleontology appear to support in great measure the concept of continental drift. If continents were once together, this should be reflected in fossil and modern floral and faunal distribution patterns. Until lately, paleontologists had

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

John Holden

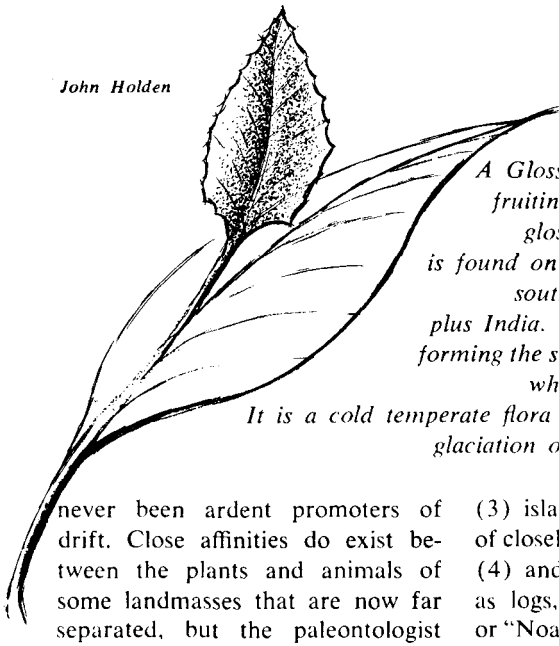


Figure 1.
A Glossopteris leaf with presumed fruiting body. The late Paleozoic glossopteris flora, now extinct, is found on and confined to all of the southern hemisphere continents plus India. They were then connected, forming the supercontinent of Gondwana which was near the South Pole. It is a cold temperate flora associated with continental glaciation of the Gondwana landmass.

never been ardent promoters of drift. Close affinities do exist between the plants and animals of some landmasses that are now far separated, but the paleontologist was formerly inclined to ascribe this to some mode of dispersion considered less catastrophic than continental drift. Drift was held to be a *sufficient* explanation but not a *necessary* one.

Let us consider some of the possible modes of faunal dispersion. The "driest" is, of course, by continental drift as this places whole landmasses together in the past. In increasing order of "wetness" we may list:

(1) foundering of large landmasses, such as the mythical Atlantis, which formerly may have connected continents;

(2) the temporary emersion of land bridges or isthmian links, such as Panama today connecting the two Americas;

(3) island "stepping-stones," a row of closely spaced oceanic islands;

(4) and by rafting of flotsam such as logs, et cetera, the "Kon Tiki" or "Noah's Ark" principle. This last-named may seem farfetched, but considering the vast extent of geologic time, it is argued, events of seemingly rare chance may happen many times.

The modes for the dispersion of living things are so diverse that they probably cannot give any final answer to the question of continental drift. Certainly it would seem to be easier to move a species than it would be to move an entire continent, but this is not the whole story. The strongest support for drift has come from the now extinct *Glossopteris* flora which formerly flourished, as revealed by fossilized leaves, at places now within two hundred miles of the South Pole, as well as in tropical India. *Glossopteris* is also found in Australia, South America and Mada-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

gascar. One may argue that this really means a more equable climate in late Paleozoic times. But a telling objection is the unlikelihood that any highly evolved plant can adapt itself to the even day-night cycle of the equator as well as to a region within the Antarctic Circle where darkness persists continuously for many months each year.

The principal reason for the rebirth of interest in continental drift has been from the results of rock magnetism. When a molten rock cools through its curie point, usually around 575 degrees Centigrade, the mineral magnetite is magnetized by the earth's magnetic field. The orientation of the earth's magnetic field is frozen, so these mineral grains become "fossil compass needles," revealing the azimuth and dip to the north magnetic pole at the time of cooling. The so-called dynamo theory of the earth's magnetic field holds that it is created by the fluid circulation of the earth's core. This motion, like that of the planetary winds, is controlled by the earth's rotation, so that the magnetic pole would always be, as it is now, near the geographic north pole or the axis of rotation. So if the continents have always been fixed in position, the "fossil compass needles" in ancient rocks should point toward the north pole. The recently chilled lava flows of Iceland and Hawaii demonstrate this expected magnetic orientation. Old rocks do not; instead they strongly suggest that the continents have moved about. North America, for example, seems to have moved about thirty degrees westward with respect to Europe since the mid-Jurassic, which suggests that the North Atlantic Ocean has opened up since that time.

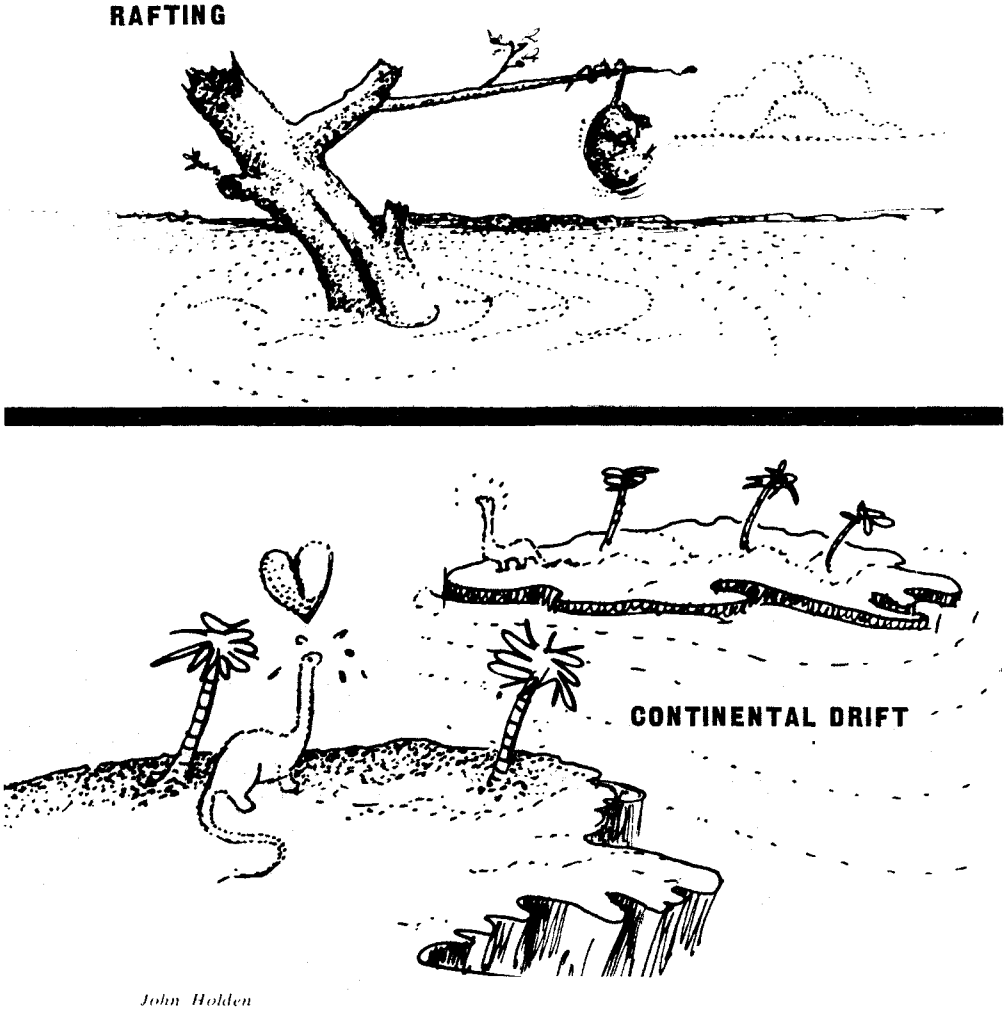
THE MECHANISM OF DRIFT

By delving into the literature on drift, I find that the nearly apoplectic rejection of drift almost invariably has stemmed from the belief that moving a continent would be an incredible, nay an impossible, engineering feat. One French geologist characterized transposition of continents on such a gigantic scale as *"incroyable, très incroyable"*. Such statements are directed at Wegener's mechanism for drift whereby continents were considered to be like ships which plowed their way through the "world sea" of the earth's mantle. Wegener appealed to *Polfluchtkraft* (pole-fleeing-force) which, because of the earth's rotation, supposedly would make continents drift toward the equator. He appealed also to *Westwanderung*, a drift of continents to the west like that of the planetary winds. If these minuscule forces were the only motivation for drift, I, too, would endorse the Frenchman's opinion.

While knowing of no reasonable mechanism for drift, some geologists have held that the evidence for

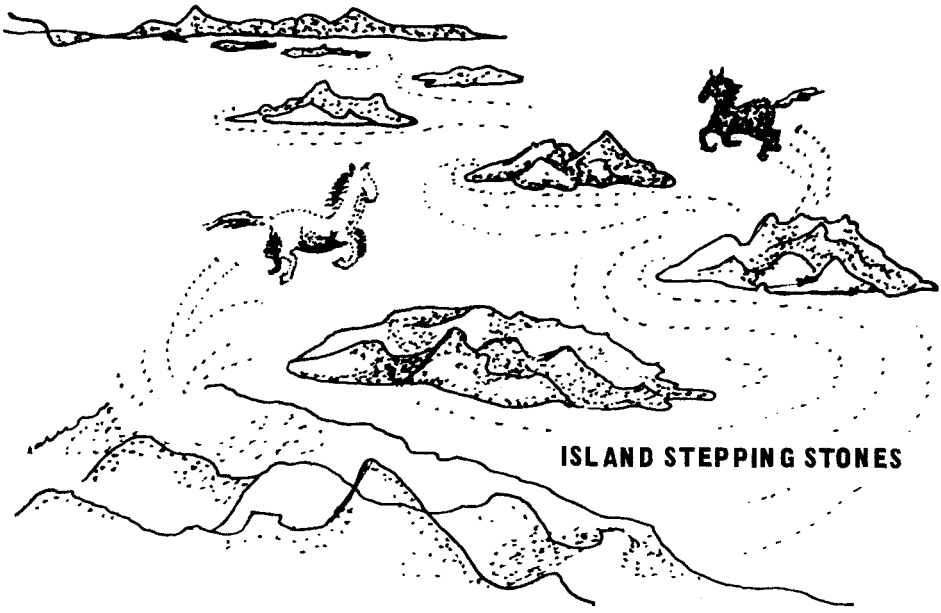
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Figure 2. Possible modes of faunal dispersion. The kinship between animals on the various continents suggests that faunas in the past have intermingled with greater ease than is possible in the modern world. Continental drift could account for this but there are other ways to explain this, too. Some modes are shown in order of increasing "dryness".

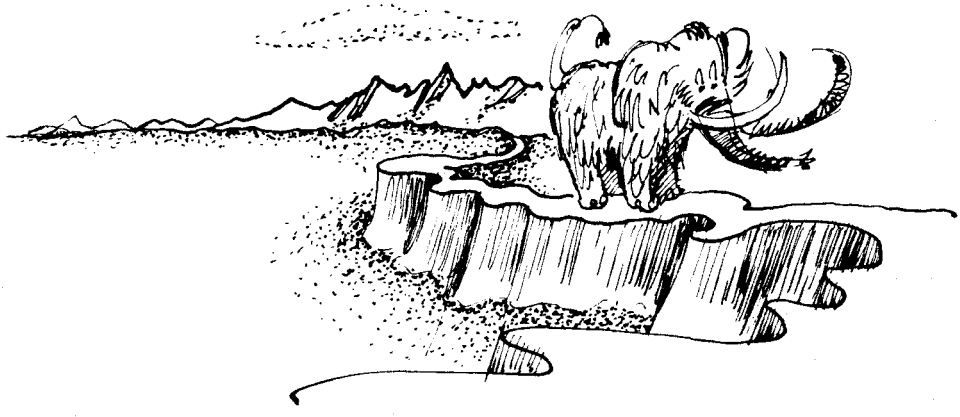


John Holden

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



ISLAND STEPPING STONES



ISTHMIAN LINKS

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

drift is so strong as to be indisputable. They argued that we should accept drift as self-evident and seek its cause later. Galileo may be cited as a case in point. Under duress of the Inquisition he was forced to admit his belief in the earth moving around the sun as physically impossible. But at the end of his ordeal he was heard to mutter, *"Eppur si muove"* ("But still it moves").

Actually there is an alternative to Wegener's drift mechanism which is both plausible and engineeringly sound. We know that the continents are tabular blocks of low density rock (called sial) and that they *do* float buoyantly supported in the denser rock of the earth's mantle (termed sima). In other words, the continents adjust themselves isostatically and are free to move up and down vertically, like ships held in a frozen sea. The outstanding question is whether the continents can also move horizontally, or if they are forever fixed in position. Now, if the mantle is a quasi-liquid, which sometimes undergoes solid flow and convective cells, then the continents would be drifted passively by the movement of the mantle. Essentially, then, the continents would be like icebergs, which, of course, are not self-propelled bodies, and even the effect of wind on them is trivial. Icebergs move in response to the currents of the sea in which they are resting. And they move inexorably, carried along by very small forces.

The convection cells I envision would be giant toroids (or doughnut shapes) invading the entire mantle from the earth's core to the continental crust. They would be fueled by the heat of decaying radioactive elements, making the earth a giant heat engine. In this manner the earth's mantle may resemble the earth's core in being mobile, with the mantle's motion being too sluggish for everyday awareness but effective over long geologic time. Very likely the earth's fluid core material moves several hundred kilometers each year while the mantle rock may shift only a few centimeters per year, or ten million times slower. It is rather remarkable that we know the deeply hidden earth's core to be liquid but motion of the much nearer mantle remains something of a moot question. This paradox apparently has arisen because of the extreme sluggishness of the mantle and because it acts as a solid for rather abrupt forces, for example in transmitting earthquake shear waves. The earth's core does not transmit such waves, showing that it is truly a fluid.

If the earth's mantle *is* slowly circulating as a quasi-solid by thermal convection, then the continents

---

Perhaps the mantle (which is a silicate material) behaves somewhat like silicone putty ("silly putty") which, if left alone for a time, flows like a liquid, but if bounced on the floor acts like rubber, yet smashes like glass if struck a hammer-blow. Its behavior is thus liquid to long-time forces, elastic to short-time forces, and brittle to extremely short-time forces.—The Editor.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

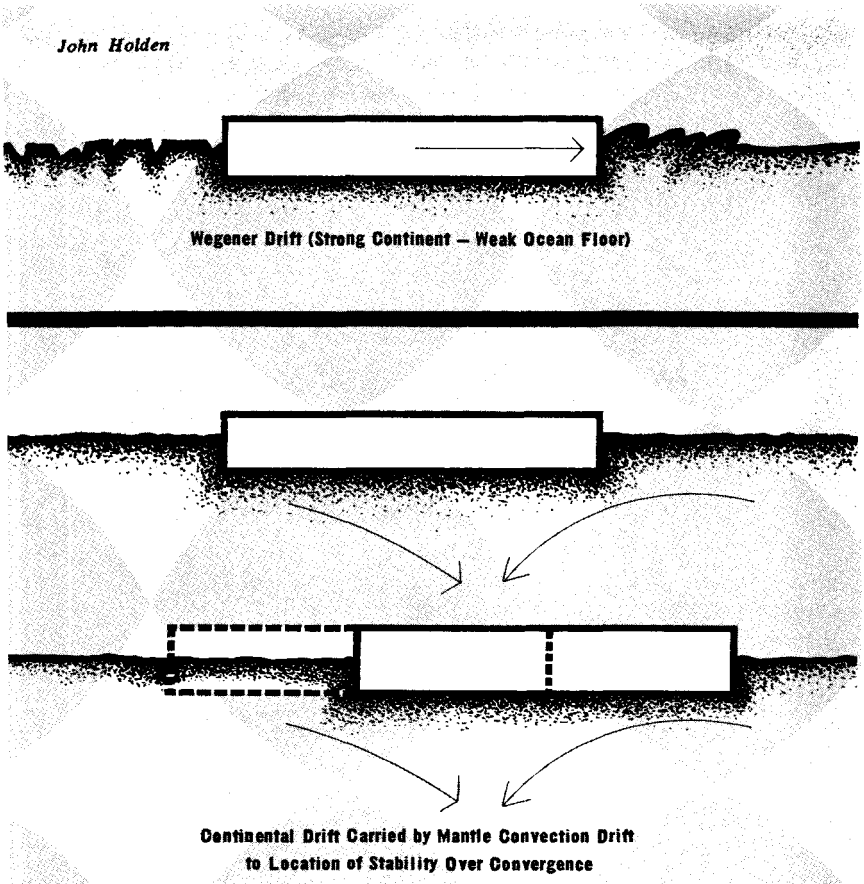
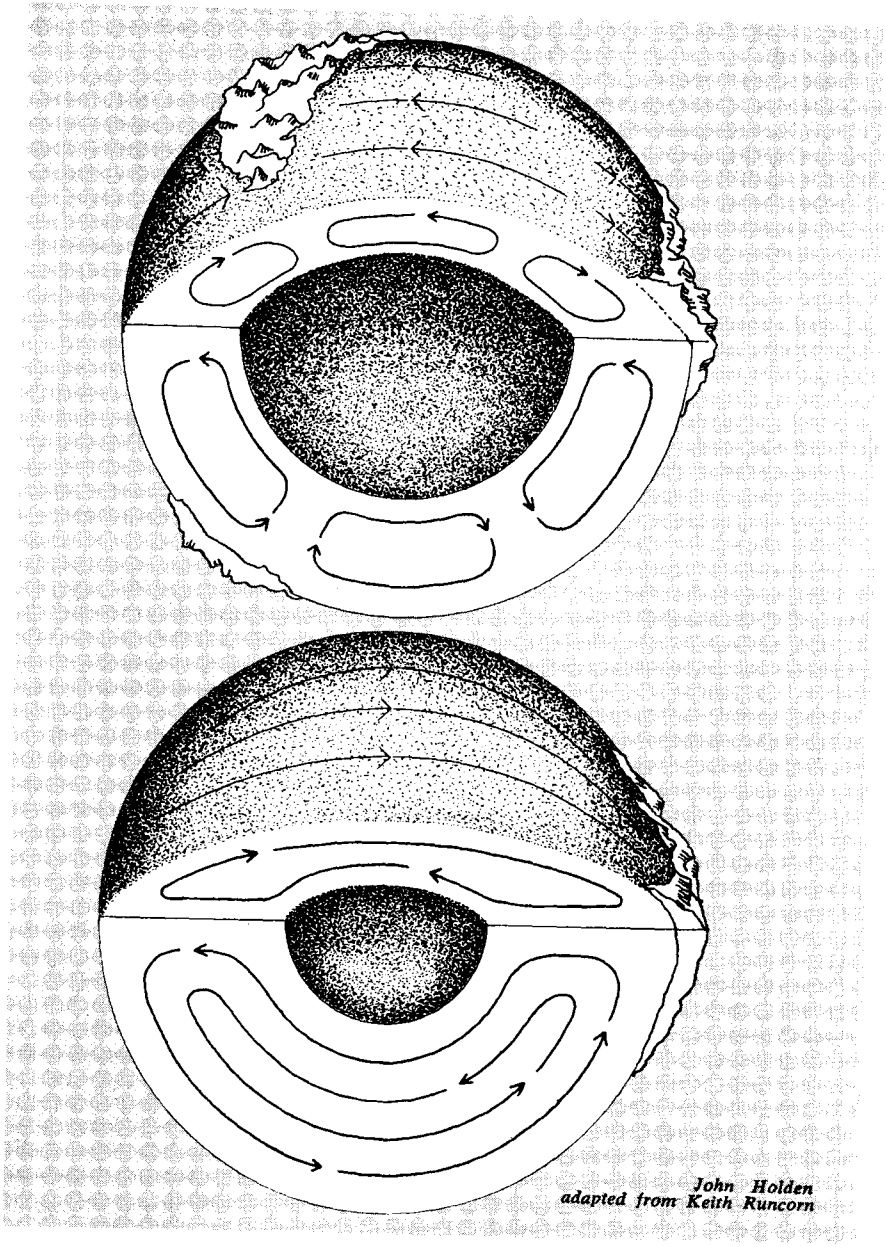

Wegener Drift (Strong Continent – Weak Ocean Floor)
Continental Drift Carried by Mantle Convection Drift
to Location of Stability Over Convergence

Figure 3. When continental drift was first proposed it was suggested that continents plowed through the earth's mantle like a ship. Such motion is apparently physically impossible and caused the rejection of the drift theory. However, if the earth's mantle undergoes convection, which now seems likely, the continents may be passively moved along on the backs of these convection cells. Continents would then be moved in the same way that icebergs at sea move—in response to the motion of the medium in which they are floating.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



John Holden
adapted from Keith Runcorn

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

would be passively drifted on the backs of these overturning cells. *Continental rafting,* rather than drifting, would provide a more exact statement of this process but there is little point in insisting on this term in contrast to the well-established usage of continental drift. Moving the entire mantle (eighty per cent of the earth) just to transport the continents may seem to some a gross violation of the Principle of Simplicity, which holds that nature is inherently lazy and takes shortcuts whenever possible. But we can only apply this principle in terms of physically permissible processes. Moving the continents like ships through the sima is not permissible but rafting them by moving the entire mantle is.

Another aspect of the iceberg analogy is germane. The ability of the sea to transport an iceberg is virtually independent of the berg's size—a giant iceberg is moved as readily as a bergy bit. Icebergs larger than the state of Rhode Island have split off the Antarctic ice cap and drifted out into the Southern Ocean. According to the United States Navy's "Sailing Directions for Antarctica" (Pub. 138, 1943) an iceberg was seen by the whale catcher *Odd I* on January 7, 1927, off Clarence Island, which was one hundred thirty feet high and measured one hundred miles in both length and width. If there were an iceberg as large as a continent, it, too, would move. If we can demonstrate that drift of sialic blocks takes place on a small scale, continents can be expected to drift as well.

Figure 4. A possible explanation for the continents moving to new positions on the face of the earth may relate to the growth of the earth's core. As the earth's core grows in size the number of convection cells will increase, causing the sea floor to spread in new directions, carrying the continents to new positions.

The movement of a sizable portion of California along the famous San Andreas Fault seems to provide a prima facie example of drift of a sialic block on the small or subcontinental scale. Along the fault, southern and western California is slowly moving *en bloc* northwestward, relative to the remainder of North America, at about two inches per year. Accordingly Los Angeles is slowly coming ever closer to San Francisco. If such movement can occur, it would seem that there can be no engineering objection to continental drift.

The San Andreas Fault is but one of several great master faults slicing through the entire continental thickness. Shearing displacements of a hundred miles or more have been demonstrated along some of these faults. Lateral offsets along under-sea faults are even more impressive. About five hundred miles of slip seems to have occurred

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

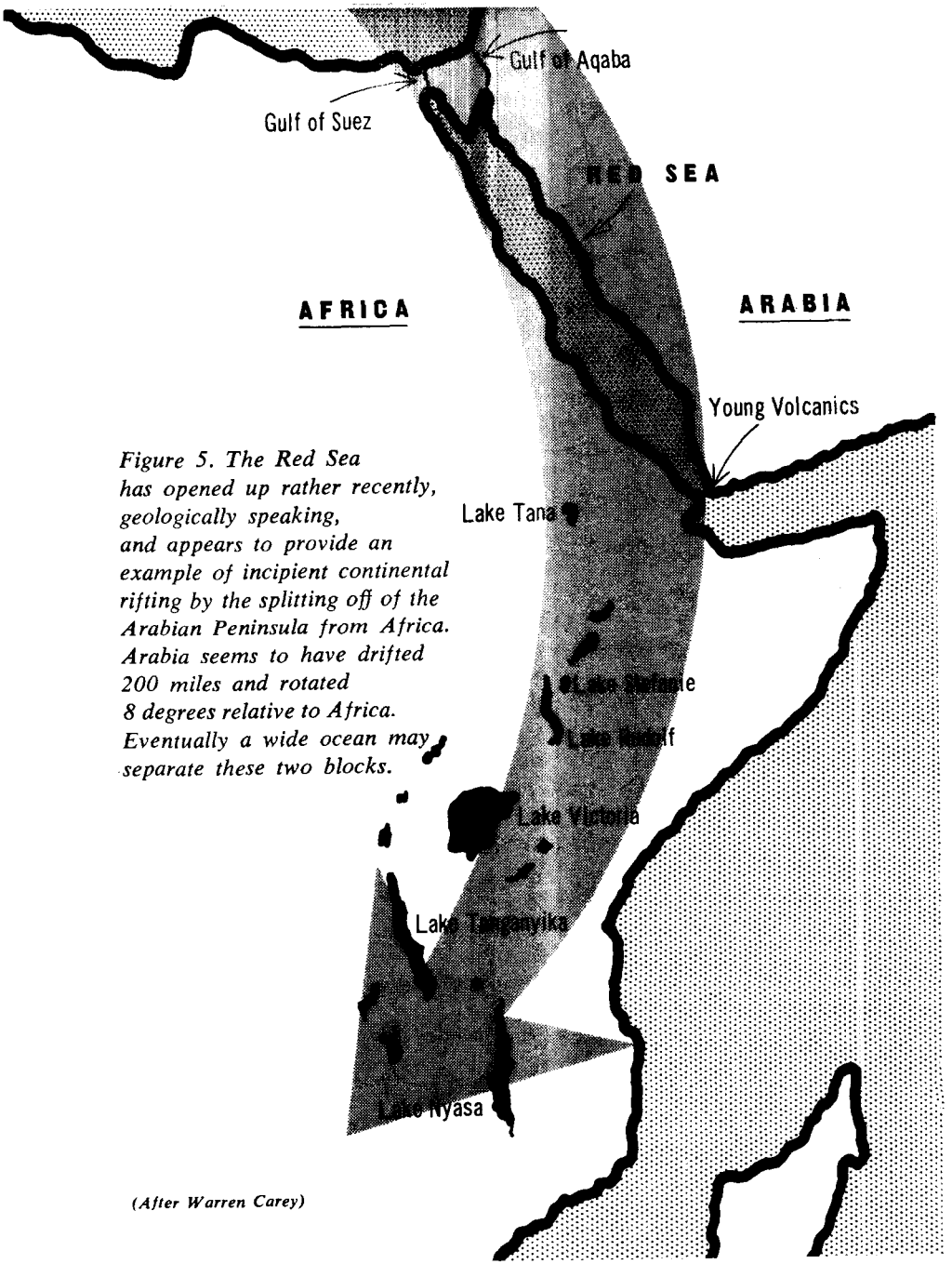


Figure 5. The Red Sea has opened up rather recently, geologically speaking, and appears to provide an example of incipient continental rifting by the splitting off of the Arabian Peninsula from Africa. Arabia seems to have drifted 200 miles and rotated 8 degrees relative to Africa. Eventually a wide ocean may separate these two blocks.

(After Warren Carey)

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

along a Pacific fracture zone extending across the eastern North Pacific, off Cape Mendocino, California. New surveys are beginning to identify similar slip zones in all of the oceans of the world. In view of this, the earth's crust seems not too rigid or fixed in position. Large differential movements can and have slipped the crust about.

An especially convincing case for the drift of a block of subcontinental size can be made for Arabia. In the last 10 million years, i.e. recently, geologically speaking, this block apparently has moved two hundred miles northwest relative to Africa, opening up the Red Sea and the Gulf of Aden (Figure 5). The Arabian block also experienced a six-degree, counter-clockwise rotation, hinging on the Sinai Peninsula. When the relatively newly formed volcanic rocks, laid down in the bend between the Red Sea and the Gulf of Aden, are subtracted, the opposing sides of this two-piece jig-saw puzzle fit together nicely. Presumably this new split will continue to grow, and Africa and Arabia some day will be separated by an ocean. The Gulf of California may be a somewhat similarly rifted and opened gap, but the evidence is much less clear.

THE FIT OF AFRICA AND SOUTH AMERICA

Among the drifters there is, of course, no single theory of continental drift—each has his own version. They *do* enjoy the common bond of shifting continents horizontally—but exactly what has moved, when and to where? Various solutions have been offered for the jig-saw puzzle of drift. One horizontal shift, however, is common to all drift theories—South America and Africa are invariably juxtaposed prior to their splitting apart about 150 million years ago (or mid-Jurassic time). The well-known fit of the eastern bulge of South America into the re-entrant of Africa, apparent on any globe, is too obvious to ignore.

The suggestion of South America and Africa splitting apart is of considerable vintage. As early as 1859, A. Snider in France sketched it in his treatise, *"La Création et ses Mystérés Dévoilés."* In 1912, Alfred Wegener wrote: "The first notion of the displacement of continents came to me in 1910 when, on studying the map of the world, I was impressed by the congruency of both sides of the Atlantic coasts." The similarity of the two coast lines has been an inspiration to all advocates of drift.

For many decades the drifters were chided for accepting "this subjective impression of a fit" gained from inaccurate sketch maps as being anything except fortuitous. In England Sir Harold Jeffries dismissed it, in his famous book "The Earth," with the remark: "A moment's inspection of the globe will show that there is ac-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

tually a misfit between Africa and South America of fifteen degrees." Wegener and Du Toit, on their part, argued that even a very rough fit supported drift as one could hardly expect that continental outlines would remain unchanged for two hundred million years considering the vicissitudes of geologic history. Wegener erroneously supposed that the seamounts of the Atlantic were residual bits of continental debris only surficially covered with volcanic effusions. He supposed, too, that the Mid-Atlantic Ridge was a remnant continental mass, the cicatrix or birth scar from which the continents departed. So the two continents had not broken apart cleanly.

Rather remarkably this fit has been carefully tested only recently, with translations being performed under proper cartographic control and the *true* continental edges fitted. This true continental edge is not the shoreline nor even the edge of the continental shelf; rather it turns out to be the one thousand fathom depth contour on the continental slope (see Figure 6). The proper matching of Africa and South America has produced a remarkable result—they fit with precision far beyond any previous expectation! Jeffries was apparently comparing shorelines, which, of course, do not give a good fit.

Actually there is one large bump on Africa for which there is no reentrant in South America. The Niger Delta bulges into the bight of Africa. It is an active delta, receiving great amounts of sediment from the Niger River. Obviously it is a recent geologic addition to the marginal outline of Africa. It only tends to confirm that the overall fit is meaningful.

While Wegener's remark that Africa and South America fit like the torn edges of a newspaper remains an exaggeration, the overlap or underlap on the best fit is rarely more than several tens of miles. Not only is there a general fit of the bulge of South America into the recess in Africa but the various bumps fit, and so do the bumps on the bumps! There seems to be no interpretation, other than drift, to explain this. At least the anti-drifters have been caught speechless (or rather, wordless) on the subject for several years now, preferring to ignore the whole issue as though it were a bad dream.

Wegener's analogy of the torn newspaper suggests that the "picture" as well as the "pieces" of the jigsaw puzzle will fit. This is difficult to prove with any certainty, because the geology of the drowned shelf fringes is wholly unknown, so that no picture at all appears along the immediate line of contact when the two continents are placed together. The printing on this "newspaper" is thus replaced with a white strip of no information. However, using extrapolation, the fit of the geologic formations seems to be

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

(After Warren Carey)

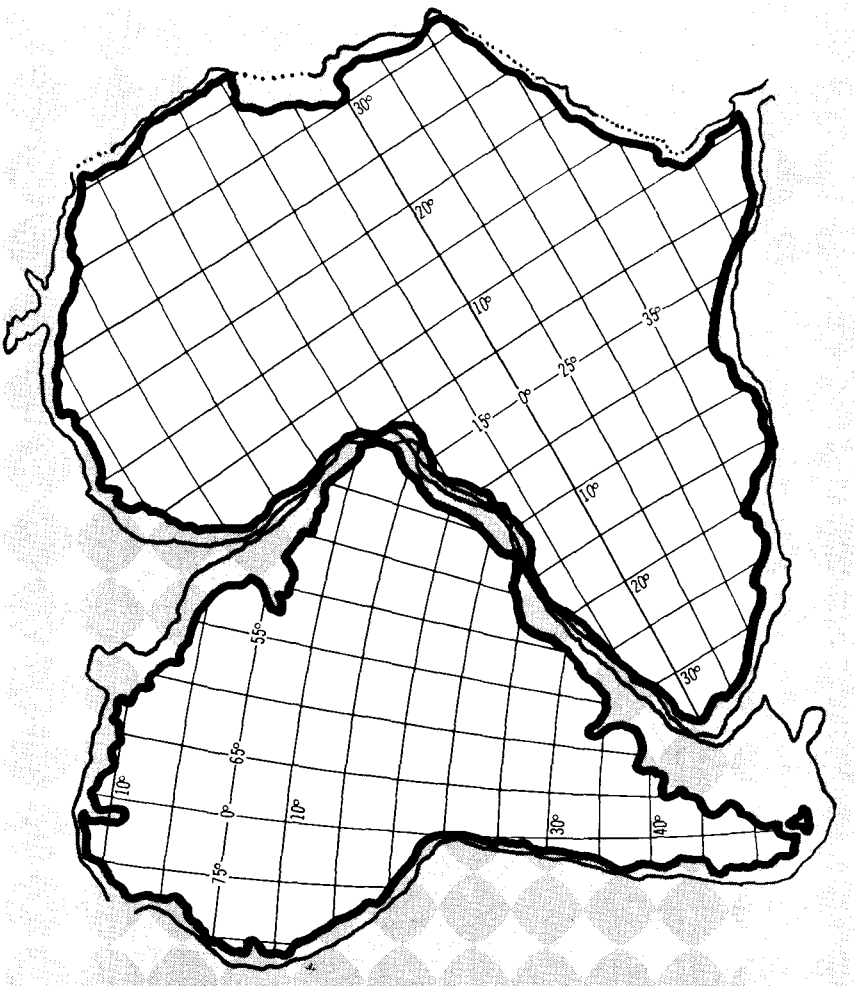


Figure 6. When Africa and South America are placed together on a common projection, they fit very nicely—not only the bumps fit but the bumps on the bumps as well! This remarkable congruency is one of the principal arguments supporting the reality of continental drift.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

fairly good, at least good enough to support the concept of drift rather than detract from it.

We must agree with one geologist's succinct remark that, "If the fit between South America and Africa is not genetic, surely it is a device of Satan for our frustration."

There is an alternative to continental drift, which has achieved some vogue of late, called *continental displacement*. The fit of Africa into South America, while giving an illusion of drift, is said to actually be caused by the expansion of the earth, which is supposed to have doubled in area in the last 200 million years. Several scientists have recently championed this view, but I am not inclined to follow.

Such an expansion of the earth would raise havoc with earth history wholly out of keeping with the geologic evidence for a rather orderly past. A great expansion of the earth is needed as its present area would have to be almost doubled over the last 200 million years—with an eight-fold increase in volume! It has been suggested that the gravitational force decreases as the universe expands and this might account for some expansion of the earth. But any such effect would be grossly insufficient for some process or effect needed which would have reduced the earth's specific gravity from 44 to its present value of 5.5. Furthermore, expansion alone is not sufficient to account for the dispersion of the early super-continents, as they have not separated like spots on an expanding balloon. Horizontal movement and rotation of continents must be invoked as well so that continental drift is needed in addition to earth expansion.

EVIDENCE FROM THE OCEAN FLOOR

It is usually said that the scientist accepts any new theory only after weighing all of the facts. This may be true for the scientific community collectively, but hardly so for each individual. The facts and alleged facts are so many and so diverse that, even if it were possible to assimilate them all, one still would not be able to fairly evaluate them in fields other than his own. Accordingly, my acceptance of drift is based upon the probable validity of broad and philosophic aspects of the problem, such as those already covered, plus the conviction that drift finds detailed support in the evidence of my particular specialty—marine geology.

A former difficulty has been the almost complete lack of knowledge as to what is beneath the oceans. With two-thirds of the earth beneath the sea, this is an enormous gap. Until recently one could assume whatever one wished about the ocean floor, so it was a realm for pure speculation without constraints. But the sea is no longer a mirror reflecting only the sky; in-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

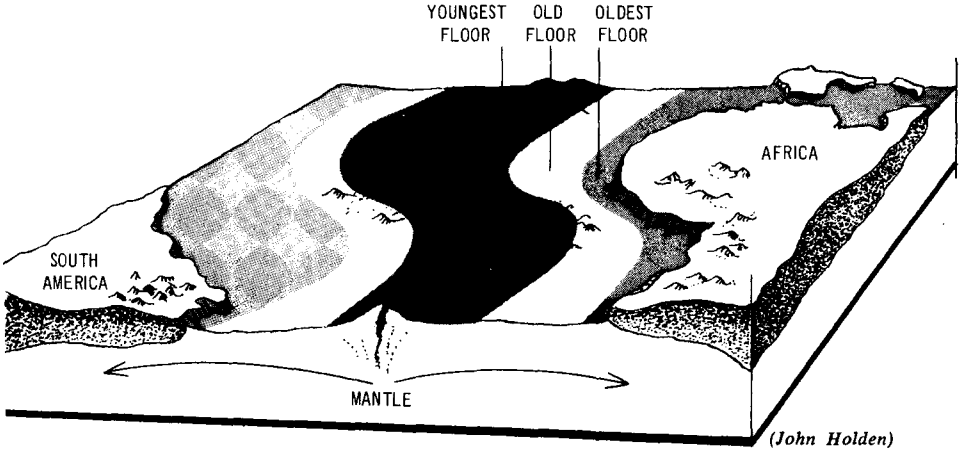


Figure 7. If Africa and South America have drifted apart owing to mantle convection, the strip of sea floor in the center of the Atlantic Basin should be the youngest. This in turn should be bounded by strips of progressively older sea floor. There is evidence that this is so.

stead it is now a window, through which much of the deeper earth structure can be seen.

Marine geology is a new science. Almost everything we now know about the sea floor has been gleaned since World War II. The new findings may be characterized as mostly surprises. But surprises can only happen to those who hold preconceived notions as to how things should be. Thus the whole classical model of fixed and ancient ocean basins has become suspect. Now, if we alter this standard model to renewal of ocean basins by drifting continents, we find that these unexpected findings are no longer surprises. They are ones which we would have anticipated.

Let us return to the iceberg analogy. It seems to me that over the past few decades, the continents have indeed proven to resemble icebergs ever more exactly. They are literally light, tabular bodies of rock buoyantly resting in the earth's dense mantle. Their relief above the deep ocean floor is simply a matter of their buoyancy, again directly comparable to the iceberg. The reality of the Mohorovicic Discontinuity (or Moho, for short), about twenty miles down beneath the continental plates, has been amply demonstrated, so the continents *do* have sharp lower boundaries rather than being deeply rooted. The continents also have abrupt peripheral margins, the continental slopes. Along many continental margins, as around the Pacific, the larger

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

geologic structures of the continent generally parallel the coastline. Around much of the Atlantic, however, these edges are "raw"—structures like folded mountains extend to the continent's edge and then are cut off as though broken away.

This is suggestive of continental drift but by no means proves it. Could not the missing mountain ranges have foundered to oceanic depth? This is unlikely, for there is no known natural force which can press a great block of low-density rock well down into a denser substratum—sinking an iceberg, so to speak. Also marine geophysical explorations have revealed no submerged block of continental rock on the sea floor off these truncated mountain ranges. The alternate explanation, that this continental rock has somehow been converted to mantle substance, is equally unattractive for reasons too complex to warrant discussion here. In the light of present-day geophysical techniques, we can no longer give the "deep six" to mountain ranges and expect them to be beyond the limits of scientific inquiry.

Another marine geologic argument favoring drift stems from the abrupt continental slopes, two to three miles high, which limit the continents all around the world. We are inclined to accept this as usual, and not wonder why. But must there not be some fundamental meaning to continental slopes being so steep, so straight and so rugged like the front of a young mountain. These are all aspects of youth, in the

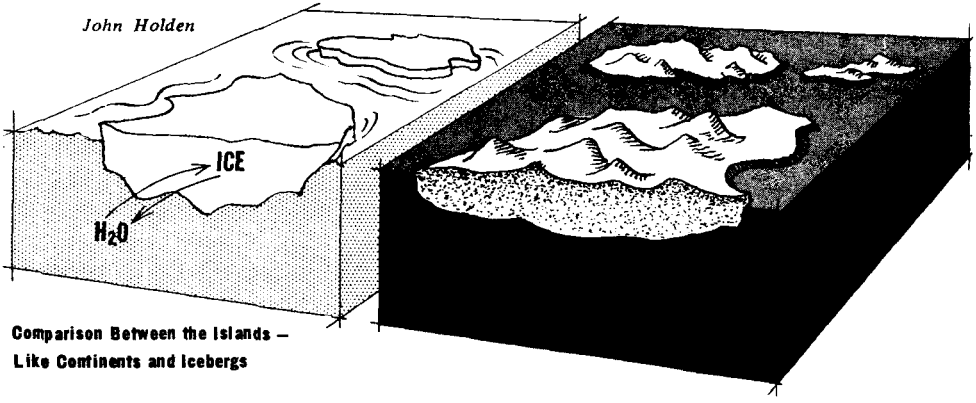


Figure 8. The continental blocks in many ways resemble icebergs, in that they float in the earth's mantle. Both continents and icebergs have definite boundaries along their bottom and sides. Like icebergs it is now suspected that continents also drift. However, unlike icebergs, continents are not simply a chemical phase change from the substance in which they are floating. Once continental rock is created it cannot change to mantle rock.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

geologist's lingo. The modern continental slopes cannot be original features of the earth, as old as the ocean basins, for then they would be "old age" or highly modified and decayed slopes tapering into the ocean basins. So these slopes, like the sea floor itself, seem to be young. This again is consonant with the thesis of mid-Mesozoic drift.

Let us turn to another question. Even admitting continents are floating like icebergs, could they not be held fixed in position as in a frozen sea? Actually, this was formerly supposed to be true. It was maintained that at least some ocean basins were underlain by a thin plate of granitic rock, the "ice" of which continents are made. We now know that no such suboceanic liner of continental material exists anywhere; the oceanic crust is of an entirely different makeup. In fact, the deep-ocean floor may be reasonably considered as exposed mantle rock, covered by a thin rind of sediment-coated hydrated mantle rock. So it seems that continents are not positioned in a frozen sea. If they were, drift would be immediately untenable; the absence of any continental material lining the ocean basins is consistent with continental drift.

If drift has occurred, the evidence from the land geology of the southern continents very clearly places the breakup as beginning in mid-Mesozoic time, or about 150 million years ago. Evidence from the sediments of the deep-sea floor is entirely consistent with this timing, for two reasons. Firstly, the thickness of deep-sea sediments is only about one tenth that to be expected if the ocean basins were as old as the earth. The mid-Mesozoic timing of continental breakup is quite in keeping with the small amount of sediments we find coating the deep-ocean floor. Secondly, although extensive dredging and sampling has been done, no one has yet recovered any fossils from the deep-ocean floor older than late Mesozoic. So the evidence on the age of sea-floor sediments is also in accord with continental drift.

Considering continents as icebergs seems to be a useful and proper analogy even to the extreme of having undergone *en bloc* drift. We should note, however, that the iceberg analogy does break down in two respects. Unlike icebergs, the continents are not significantly more rigid than the mantle in which they float. And unlike icebergs, the continents are not simply a phase change of mantle rock. The material of the continents cannot be converted back into mantle material like ice into water. There is every reason to believe that continental rock, once present on the earth's surface, cannot be again "digested" by the mantle.

EARTH AND MOON

Perhaps the clinching proof of continental drift will come not from the earth but from the moon. We

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

know the earth's core to be liquid and continental drift requires that the earth's mantle be quasi-liquid. On the other hand, a small asteroid is simply a rock in space. The moon has only little more than one per cent of the earth's mass, so quite possibly it, too, should be like a rigid rock in space, and show no evidence for drifting of its crust. This seems to be true. The moon is peppered with the circular forms of craters and maria. Their origin aside, the moon's surface is a museum collection of landforms which were born circular and remain circular. Over the aeons, the lunar crust may have been kneaded by the tides, but nothing has really ever slipped. If large offsets had occurred, they would be clearly evident against the reference grid provided by the lunar craters. Crustal movements also would have distorted and squashed the older craters at least, but we see no evidence of this. In brief, the contrasts between the earth and the moon suggest that our continents have moved about, while the lunar crust is rigidly fixed. If this is so, one may in turn speculate about two other nearby planets, Venus and Mars, which are likely to be visited in this century. There is at least some slight evidence that they will turn out to be more like the moon. Observations on the figure of Mars suggest that it is quite rigid, while the recent Venusian fly-by indicated no appreciable magnetic field. This suggests, in turn, no liquid core and thus a body which is undifferentiated internally—although Venus has eighty per cent of the earth's mass. It would seem, then, that the earth may be just big enough to have developed its core and quasi-fluid mantle, resulting in drifting continents. It acts almost like a rigid body, but not quite.

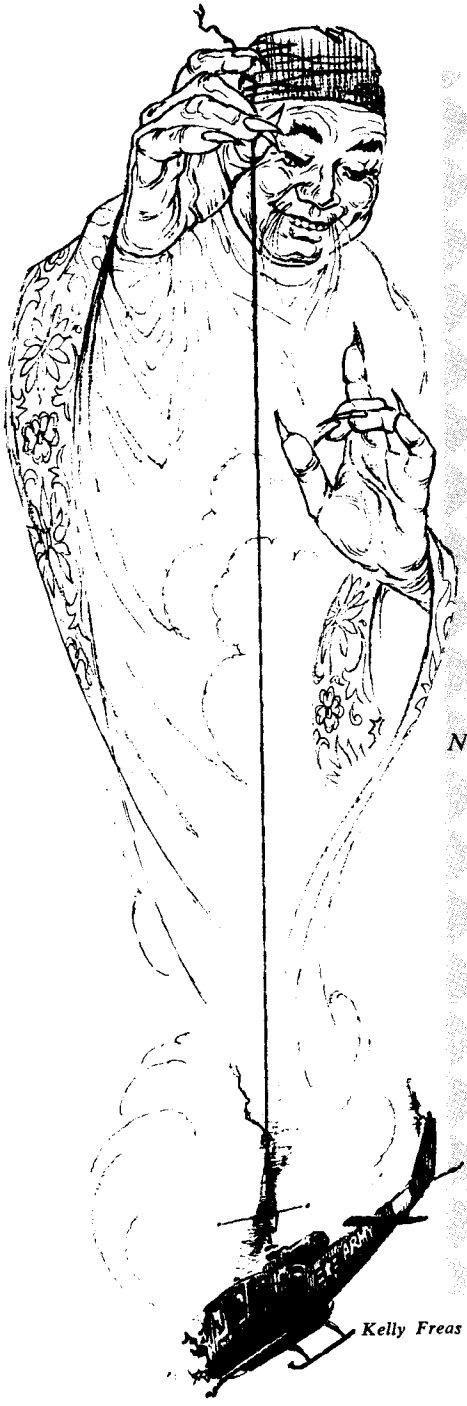
CLOSING REMARKS

The significance of continental drift goes far beyond the question of whether they have moved about or not. The fundamental behavior of the earth is at stake. If drift has occurred, much of what has been written about earth history will be rendered obsolete or will need revision. The non-drifters will not yield the classical model of a fixed earth readily—nor should they. Many tangled miles of typewriter ribbons and reams of paper will be expended before any consensus on the question of drift is reached; the argument is now only warming up.

Continental drift remains highly speculative but at least now it has attained scientific respectability and vogue. Certainly the older theories about the earth's behavior and its history, based on vertical movements alone of otherwise fixed continents have proved inadequate for explaining the new discoveries about the nature of the earth beneath the ocean floor. ■

Since the submission of the manuscript, the predicted similarity of the Moon's cratered surface with Mars has already been demonstrated by the Mariner IV photos.
The Editor.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



Who Needs Insurance?

ROBIN S. SCOTT

He had—though he didn't know it—a most unusually good value in his insurance. Naturally enough he didn't know what was being done for him—or why!

I've always been a pretty lucky guy. I don't mean at cards or even—before Marty—with women. Just lucky in the sense that my ration of ill fortune has always been slight. All my life I seem to have walked dry through the shower of vicissitude which seems to be the normal human lot. I never broke a bone as a kid or had more than the usual run of childhood diseases. I never piled up a car, or had appendicitis, or suffered food poisoning, or got cleated by that vicious fullback who played for Carrolsville before they

Kelly Freas

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

threw him out in 1941, the year I graduated from Mumford Junction.

And because there are lots of others I've known who seemed lucky in this way, I never suspected my luck was any different—more than just plain "luck"—even after the Ploesti raid. It wasn't until Vietnam that I became convinced that my luck was really out of the ordinary, and even then I didn't really understand it. I never would have known what it really amounted to if it weren't for Marty. But I'm getting ahead of myself.

Ploesti was a simple enough thing. That I survived the raid was good luck indeed, but not *unusual* good luck. Lots of others survived, too. The unusual part was the *way* I survived.

I was copilot of a pretty rickety B-24 attached to the 389th Bomber Group, which, we discovered later, had somehow slipped through its last maintenance check without being checked. Anyway, we'd come in from the southwest, over the rolling foothills of the Transylvanian Alps, made our bomb-run on "White One" without taking many hits, and slid weaving out through smokestacks of the refineries at about sixty feet. We were just beginning to congratulate ourselves on getting through what was obviously one of the hairiest raids of the war. I had just turned a little in my seat to see if George wanted me to take it when an 88 mm shell popped in through the nose canopy, through the bombardier, and exploded somewhere above and behind us, knocking out both inboard engines.

Funny how suddenly aware you can be at a time like that. My whole life did not pass before my eyes; I was much too busy watching the curious, almost slow-motion effect of eight pounds of high-explosive and fine German steel. There was light, of course, like a hundred flashbulbs going off at once, and there was heat and blast. George simply disappeared. So did his yoke and several feet of fuselage. The nose canopy was gone and the sudden drag and the blast threw me forward against my yoke. I grabbed it, surprised that I could still grab, and looked to see if I had any feet left. All I could see was gore, but it wasn't mine. It was the bombardier's. He was a young kid, a year younger than my ancient twenty, and I can't even remember his name.

My being thrown against the yoke nosed us down enough so that we didn't stall out then and there, and I was able to get us a little flying speed before we ran out of air and joined the Rumanian underground. I went to full power on Number One and Number Four and we got on out of there. Major Ericks, the Squadron Intelligence Officer, was riding observer and doubling at one of the waist guns. He stuck his head in through the hatch, took one look at the mess, and went back to the waist, praying

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

—as he told me later—all the way.

So that was the first miracle of the Ploesti trip—that I had survived that 88. When we got back to base at Benghazi, no one could believe what they saw in the cockpit of the *Goldbrick*. One half—the pilot's—completely torn apart; the other—mine—almost untouched.

But it wasn't all that easy getting back to Benghazi, and that's the second miracle—real unusual stroke of luck if you will—of my visit to Ploesti, the oil capital of Rumania. We'd clawed our way on two engines up to thirty-five hundred feet, and I was beginning to breathe easier when whacko! Oil pressure on Number Four dropped to zilch in about ten seconds. I could see the black gold streaming out through the cooler flaps. I pulled off power and feathered, and we were lucky again: no fire. But that is usual luck, although very good luck indeed. What was unusual was this: a B-24 can, if you are very lucky and not heavily loaded, maintain altitude on one engine. But not with most of the front end of the airplane missing. No sir. It ruins the streamlining, and as they used to kid us at Randolph Field, "that which draggeth, falleth." So I fiddled along without much real hope, trying to coax the maximum thrust out of that poor, tortured Number One engine, and calculating how far we had to go in order to jump into that part of Yugoslavia controlled by Tito.

I boosted the mixture to rich and increased pitch slowly, trying to keep manifold pressure somewhere in the neighborhood of the red line. And then I discovered it. *I could pull the propeller to full high pitch and the RPM's didn't drop!* The prop was roaring like an insane lion and chewing great chunks of air with each revolution, but it didn't slow. It took all my strength with both feet on the left rudder pedal to keep us from crabbing around into a flat turn. I figured out later that strange engine had an effective power boost equivalent to an extra eight hundred horsepower, and that in a twelve hundred horsepower engine! Right then, though, twenty-five hundred feet over Yugoslavia, I didn't do any figuring. I was just too shook to be anything but properly grateful.

So we went bucketing and yawing down across the Balkans, down through the Ionian Sea and across the Mediterranean to Libya. I was into the slot for an upwind approach when both outboard engines went bang, and I mean exploded. I could understand Number One going. It had roared long enough and had earned the honor of a decent burial. But old Number Four had been loafing on full feather and hadn't turned a lick for almost five hours. Anyway, both went bang, Number One deserting us entirely, whistling down to bury itself in the sand off the end of the Four-Five runway, while Number Four burned

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

merrily in its cowling, although with no oil and only a carburetor full of gas, without much real malice.

Despite everything, it was a satisfactory landing, and like the rest of the slobs who had visited sunny Rumania that day, I was too thankful to be back in one piece to speculate much about the nature of my good luck. It wasn't until a couple of days later, after a very alcoholic evening in Major Ericks' tent, that I began to get really curious about that Number One engine and its evident ability to do full RPM's at full high pitch.

I can't stand being curious. It's like an itch, a painful irritation somewhere deep inside, and I have to scratch. I went to see Mcdougal, the Chief of Maintenance for the 389th. Like me, Mcdougal had been pulled into the Army Air Corps from college. But, while I had put in only two years at Indiana, Mac was doing graduate work in Fluid Mechanics when he was offered a choice between civilian work on some highly classified project in a little Tennessee town named Oak Ridge or a direct commission in the Air Corps. Mac is a little unconventional and a little nuts, and he thought he'd have a better time in the war if he could smell gunpowder. He was the sort of Maintenance Chief who used to sneak rides as gunner, radioman, flight engineer, what-have-you. He could even fly passably well.

It was after ten in the evening when I caught up with Mac. The desert heat had been sucked off into a series of towering thunderheads which instead of shedding their favors on Libyan soil would undoubtedly move out into the Mediterranean and kick hell out of some poor Greek sponge fishermen. It was cool even inside the silver corrugations of the R & M hangar, and Mac was relaxing with one of those thin little books on mathematics which have no numbers in them, just alphabets, and which cost about twelve dollars a running inch. I went to see Mac because I had to scratch my curiosity itch, and because besides being a first-rate technical mind, Mac had been a friend since we had been boys together in Mumford Junction.

Mac offered me a beer from the avgas compressed air beer cooler in the corner of his office and set me at ease with the back-home southern Indiana drawl he affected. I'd lost mine at Bloomington, in college. MIT and the sophistication of Boston had intensified Mac's.

"How's it goin', Ace," he drawled. Mac called everybody "Ace." Everybody he liked, that is.

"Like a hawg with both feet in the trough," I answered, slipping back into Mumford Junction to make Mac feel good.

Mac took a long pull on his beer. "Just about creamed yourself on that Ploesti party, didn't you?" He looked out from under his bushy red eyebrows and down his long

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

arched nose at me, and his eyes twinkled. "I'm glad you made it, Ace."

"Thanks, Mac." His pleasure was sincere, and I was touched. "Have you seen what's left of the *Goldbrick*?"

"Yeah, I seen it, and I seen better lookin' junk spreadin' fertilizer on your old man's back forty. You could just as well have left it for the Krauts in Ploesti. I ain't gonna be able to fix it up none."

"D'you check it out before you scrapped it? Go over the engines or anything?"

"What I wanna do that for? I had a crew pull out what we could use for spares and then tow the carcass over to the boneyard. Anyway," he exclaimed, sitting up from his moribund slouch, "one of them engines is all burned up, two is shot to pieces, and I b'lieve you buried the other with full military honors out there off'n the end of Four-Five runway."

I explained about flying all the way home from Rumania on one engine and about the extra eight hundred horsepower. This really sat him up. He uncurled his six-foot-four and went over to the beer cooler, eyeing me all the time. He knew me too well, however, to go into the "you must be nuts."

"Full RPM at full high pitch, eh?" he muttered as he opened a can for himself and one for me. His can opener was a tool steel die set into an unpowered drill press.

I didn't answer his mutter. He paced a moment, the foam from his beer can dripping to the concrete floor, and then: "Come on, Ace. Let's go dig that baby up."

He called for a crash truck, and beckoning to the duty crew chief, he swung behind the wheel and we sped off through the cool desert night, bumping over the low dunes at the end of Four-Five. Even with the blackout lights, it didn't take long to find the crater. There'd been plenty of oil pressure in that engine when it blew loose from the *Goldbrick*, which meant the reservoir in the oil cooler had been pretty full, and the sand around the crater looked like the backyard of a filling station.

We cleared sand away from the corpse with shovels, and then while the crew chief was loading up with the crash truck's A-frame, Mac and I walked around like a couple of whitewings, picking up the bits and pieces. When we had pretty well policed up the area, we ploughed back to the R & M hangar, unloaded our booty on the oil-stained concrete floor, and Mac went to work. I had a beer and went to bed. I had to fly the next day.

It was a milkrun—the courier flight to Gibraltar; likewise the day after that. Then another hairy one came along, this time up in Sicily, but the Group had to stand down two days in a row because of bad weather over the target area. When

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the weather finally broke, my plane had to abort when we couldn't get a decent magneto check. I taxied back to the hangar, sore at the world. I didn't like aborts. A runner met me as I swung down through the hatch. "Lieutenant Albers, sir, Lieutenant Mcdougal says he would like to see you at your convenience." I acknowledged the message and shuffled over to the R & M shop, still sore at those magnetos.

Major Ericks was sitting in Mac's tiny office, his feet up on the beer cooler, a white moustache of foam on his upper lip. The cooler, carefully vented to allow the evaporating gasoline to escape safely, kept the small office a few degrees cooler than the sweltering hangar which surrounded it. Major Ericks is a fat little bird with sleepy eyes, and he was obviously enjoying the coolness of the beer and the office. He is a deceptive man with those eyes. He looks like a retarded Santa Claus, but I saw him fracture a Berber's skull with the side of his hand one time in a barroom brawl in Tripoli. He talks like a college professor, which is not surprising since that is what he was before the Great Unpleasantness—as he called it—broke out in 1941.

"Peter!" he exclaimed when I walked in. "I've not had a chance to properly thank you for your magnificent performance last Sunday. You had me praying, and the unaccustomed exercise did my fat soul good."

I grinned and accepted the beer from Mac. "It must have been the prayers that did it, Major. By all rights we ought to be walking across Transylvania at this moment, dodging Germans and werewolves."

The major chuckled. "I hadn't thought of it, Pete, but I suppose you've a point. Perhaps we should include a silver spike in the escape and evasion kit for Ploesti-bound fliers."

Mac, who never read a book unless it was one of those twelve dollars a running-inch types, looked mystified and turned the conversation to business. He is an inarticulate man, and when he has to address more than one man at a time, he gets a little nervous.

"Major, I asked you an' Ace here to come over on account of I got a problem I can't handle and maybe you can gimme an idea." He stopped abruptly, not sure where to begin.

"Is it the business with the Number One engine from *Goldbrick*?" I asked.

"Yeah," said Mac, and I explained the problem to the major.

"Ah tore it down," continued Mac, "and there wasn't a thing unusual about her. She was a fine, healthy engine before she blew, but I couldn't figure out for the longest time where she was gettin' all that extra power. Then I found this." Mac pulled a wheeled dolly over to the two of us. On it was a square box, about ten inches on a side and maybe five inches thick. Its surface

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

was featureless except for a series of bolt holes along a flange on one end and a helical gear extending from a short shaft on the other. "This was bolted in and geared to the flywheel, and it don't belong there."

"Doesn't belong?" queried the major. "What do you mean?"

"Look, Major," said Mac, "we get maybe six . . . seven modifications a month in these here airplanes. Maybe two a month in the engines. Every one of these mods go through me. I'd know for sure if we was to install little boxes like this geared to the flywheel." Mac's voice carried an injured tone, almost as if his honor had been slurred. "And more'n that, Major, it don't *do* nothin', this little box. It don't take power in and it don't put power out, least not so's you can tell."

We were silent for a minute. Then I said: "Why don't you open her up, Mac, and see what's inside. Maybe you can figure out what it's for when you see the guts."

Mac gave me a pitying look. "You think I ain't *tried*? I've tried everything but a cuttin' torch on her, and no luck."

The major peered at the box intently. "Get your torch, Mac. Let's see what's inside."

Mac left wordlessly and returned a moment later with two gas bottles on a cart. He pulled goggles down over his eyes, lit the gas with a pop, and adjusted the valves until he had a good flame. I watched the box as he heated one end with the flame. The term "black box" had not yet come into currency, and this utterly mysterious, completely unknowable box was not black at all. I watched as its gray-green exterior began to glow cherry red, watched as Mac thumbed the oxygen valve for a cutting flame. I watched as the entire box suddenly turned to grayish powder and melted and formed a hard little ball and danced and sizzled on the steel top of the dolly. And I saw Mac cut off the gas and push his goggles slowly up onto his forehead, and I saw Major Ericks sigh and look at me with a strange glint in his eyes, and I began to suspect then that I had had unusual luck at Ploesti—more than the sort of extra-special good luck that almost everyone experiences now and again.

So we had a mystery on our hands, Major Ericks, Mac, and I. But we didn't particularly relate the mystery to me, Lieutenant Peter Albers. Having had my very personal bacon saved by the mystery led me to relate it to myself—to wonder "why *me?* why *my* airplane?" —and maybe Major Ericks was feeling the same way about himself. But as a group, sitting around as we did for weeks afterwards, drinking beer in Mac's cool little office and speculating about the golfball-sized chunk of glassy slag that sat on Mac's desk, we didn't relate the mystery to me. And after a while

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

we began to forget about it and talk of other things. We were all pretty close by then. Bill Ericks had flown with me a good deal, explaining in his offhand way that he wanted to share what he called my "flair for Providence." And he and Mac came to respect each other in the abstruse world of mathematics. Mac even began to call him "Ace."

And we stuck together this way, sitting in one R & M hangar after another, talking politics and girls and airplanes and girls and the world series and girls, until the war was over. After Ploesti a lot of little things conspired to keep me in good shape. I flew plenty, but it seemed like there was always a shot magneto, or a leaky hydraulic line or a cracked de-icing boot that kept me on the ground when the bad ones came along. It was only much later that I saw how these many tiny things added up to be a bit more, in aggregate, than ordinary circumstance. Like shooting seventeen straight passes or drawing to an inside straight two or three times consecutively.

After the war, we drifted apart, despite our protestations to the contrary. Bill Ericks got an Associate Professorship at some eastern college, married a girl from Smith, and wound up finally as a wheel in one of those Government outfits which are too secret even to have alphabetical names. We exchanged Christmas cards for a while, and I ran into him once in 1955 coming out of the Dorchester in New York. Mac went back to MIT to finish his degree, married a girl from back home in Mumford Junction, and took her out to California with him in '52 when he went to work for one of the big R & D outfits out there that were springing up like weeds on the rich diet of Federal money following the outbreak of the Korean war. Mac never wrote, but his parents lived on in Mumford Junction, as did mine, and I followed his travels through them.

As for me? I finished up at Bloomington with an MS in Aeronautical Engineering in 1949 and went to work for one of the big airframe manufacturers in Kansas. After a year on the board copying other men's ideas, I was glad to be rescued by the Korean War. I was retreaded as a captain and learned to fly A-26s, but the same combination of hydraulic lines, fouled-up radio gear, and erratic magnetos—speaking metaphorically—kept me out of serious action, and I flew two combat tours without a scratch. I left Korea as Major Peter Albers, the "lucky Pierre" of the 2731st Recon Squadron, and after two wars and over four thousand hours of flight time, I figured I'd just as well stay in the Air Force and make it a career.

My luck—as I explained before—didn't extend to the realm of women: A. I hadn't met many girls who were prepared to put up with a rather tired-looking caricature of

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Lindbergh with a rapidly-receding hairline and too much length to stuff into a standard bed. And B, the ones I had met who were willing to accept the material described in A. (above) seemed to consider marriage a kind of Inertial Navigation System with which they could accurately plot my course for all the years to come. And if there is one thing about me, it is that I like to at least pretend that I am the Captain of My Own Soul and the Master of My Own Fate (to paraphrase Henley).

You might think it strange that lucky Pierre Albers, by his own admission an independent sort of bird, would choose a military career, with all its traditional restraints. Well, I suppose it's the same in Big Business and Big Government, and even Big Labor: you learn the ground rules, the taboos and the angles, and then if you can produce you're left pretty much to yourself. I knew the rules in the Air Force—I'd had (by 1953, when I finally decided to make a career of it) seven years of practical experience, and I figured I could have a fairly satisfactory life, doing what I most enjoyed, with a minimum of interference from outside sources. And I had my luck. By this time I had come to count on it. Not that I got sloppy in my flying or anything; I just always knew it was there. And this made what is otherwise a career hard to insure—not many people realize that most military pilots in those days had to pay as much as fifty per cent more for insurance—even more attractive. All that flight pay and nothing to lose.

So the years rolled by. I was often lonely, all bachelors—despite their claims to the contrary—are. And sometimes, in lonely moments on a long flight at very high altitude or in the middle of the night in the BOQ, I'd think about the Ploesti raid and about that gray-green "blackbox." But this was mostly middle-of-the-night stuff, and I had long since given up bringing up the story in bull sessions. Too damaging to the reputation, and pointless anyway.

I rolled along, piling up safe hours in all types of aircraft. In 1955 I was promoted to light Colonel and shifted to flight test duties—the degree in Engineering did it—and I rolled and twisted hundreds without incident. In 1961 I got my eagles, and in mid '63 I was given command of a helicopter squadron in Vietnam. And then, a few weeks before I was due to be relieved in the Spring of '64, I found out some more about my unusual luck, my "chicken sandwich" luck: Mac used to say in Libya, way back when, that with luck like mine, I could reach into an Arab privy and come up with a chicken sandwich.

We were working our way up the Mekong River in H-34s—Choctaws, the Army called them—dropping supplies here and there in friendly

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

villages, setting down to drop off squads of replacements, and generally doing our bit to hold together the whirli-bird lifeline of the miserable Vietnamese war. I had been loaned to the Army because I had worked with H-34s a good deal and the Army was rapidly growing short of trained chopper jockeys on the command level. I'd been actually leading the squadron in combat for nearly a year, and had I not been so convinced of my own invincible good luck, I'd have realized I'd just about outlived the statistical odds for survival in that unhappy part of the world.

On this day in particular, the great muddy Mekong lay spread out some five hundred feet beneath us, swollen and fat from the spring rains. There were spots of early morning mist obscuring the banks and the horizon was a purple band of dampness no more than two miles away. The Viet Cong held a strong point on the west side of the river and they had developed a new trick. They would anchor a small boat or a raft out in the middle of the river and zero in on it with their little dinky 3″ mortars. Then, knowing we used the river to navigate by when we were flying resupply, they calculated a series of trajectories for various altitudes, and when we came flying by, they would fill the air with big, lazy mortar shells with timed fuses.

Well, we caught one. And it was Ploesti all over again. No gore this time, although the crew chief back in the cargo compartment had a pretty lively fire on his hands for a few minutes. Otherwise the damage was slight. The rotor blades were nicked and vibrated like hell; there was rice and "C" rations plastered all over the interior of the cargo compartment; and there was a hole about the size of the southern tip of Florida in the main fuel tank. I got us stable again and headed back to base, pulling off power to conserve gas. The main tank was soon empty—without fire, thank my usual, everyday, run-of-the-mill luck—and I started nursing throttle and mixture control to stretch the two reserve tanks for the two-hundred mile flight back to base.

By all rights and the laws of aerodynamics we should never have made it. But I found I could throttle way down and still keep a steady thirty-five knots and full stability, and as we flew along, the engines barely turning over, I began to realize that my unusual, more-than-run-of-the-mill luck had taken hold. And sure enough, some five hours later when we began to windmill in over the base, there was a loud report, as if someone had dropped a grenade into the engine, and we came flopping like a wounded bird into a safe but destructive no-power landing.

We all walked away from it, and after debriefing the other members of the squadron and reporting in to

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Operations, I borrowed a tool kit from one of the mechs and headed for the boneyard where they had towed the remains of the Choctaw. I had a good idea what to look for and where to look for it, and it took only a few minutes with a flashlight and a set of sockets to get the gray-green box loose from its mounting next to the flywheel.

Twenty years is a long time, but that strange box, identical with the one I had seen in Benghazi, except for the cut of the teeth on the spur gear, brought back my memory with detailed precision. I sat and stared at it where it lay on my bed in the BOQ, and then I stuffed it into the bottom of my foot locker while I thought the whole thing over.

A month later, in June 1963, I rotated out of Vietnam with reassignment to the Air Force War College at Maxwell AFB in Montgomery. For a professional warrior, such an assignment is to be treasured: it is one of the most essential elements in the construction of a general officer, and to have made it at forty-one—and not as an Academy graduate—made me feel doubly-blessed. As a consequence, I rapidly lost interest in the mystery posed by the gray-green "black box." It knocked around with me in the bottom of my foot locker on the trip from Saigon to Washington and then on to Mumford Junction. I thought about it occasionally, and I couldn't help but be intrigued by the long recurrent thought, "Why me?" During my six weeks leave in Indiana, there were too many other things to do and to talk about, too many sea stories to swap with old friends, and too much to do helping Dad with the farm and enjoying the simplicity of a midwestern summer to fret about what was obviously—to me, then—unknowable. After a while, just before I left for Montgomery, I packed the strange device carefully in a crate, determined Mac's address from his mother, and shipped it off to him with a brief letter describing the circumstances under which I had found it.

By the end of October I had been at the War College a couple of months and was doing well. Thus it came as a bolt from the blue when I received sudden orders detaching me from the War College and instructing me to report to the Pentagon, room such-and-such, Colonel so-and-so. Colonel so-and-so wasn't much help in clearing up the mystery. Instead he handed me the address of an apartment house over in the District and told me to report back to his office once a month to get paid. Otherwise, he wasn't interested in seeing me anymore. I was sore; I didn't welcome missing out on the opportunity presented by the War College, and I didn't like the Mickey Mouse mystery I was being handed. But Colonel so-and-so accepted my indigna-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

tion with bland indifference, and if you've ever seen two colonels trying to pull rank on each other, you can imagine how comical the scene in room such-and-such was.

As I said, I had been in the Air Force long enough to recognize the fact that there are times when You Can't Fight City Hall, and just then, Colonel so-and-so represented City Hall. There were the initials of the Secretary of the Air Force on my orders to prove it. So I swallowed my anger, hailed a cab, and went to the address on Connecticut Avenue I'd been given. It can be hot in Washington in October, and the air-conditioning in the Grover Apartments did nothing to cool me off. Suite 8334 was high in the building and I had to wait a long time for the elevator. But my frustration and anger died in puzzlement when the door was opened to my impatient buzz by none other than friend Mcdougal, older, his face wrinkling, his red hair salted with white, but indubitably Mac.

"Howdy, Ace," he grinned. "Ah hope you ain't too put out at bein' drug up here like this."

Before I could answer, my surprise was compounded by the appearance of Bill Ericks, feet up on the suite's expensive upholstery, a can of cold beer in his hand. Suddenly twenty years dropped off me. The jumbled events of the past few hours shifted into neat rows, all in perfect alignment, and I knew what it was all about. I shook Ericks' hand and took the proffered beer from Mac. "What is this, Libyan Reunion Week?" I said, as if I didn't know better.

Ericks chuckled. "Better call it the organization meeting of the Pete Albers Little Green Box and Marching Society." He turned to the entryway leading to the rest of the suite and called: "Marty, our rabbit's foot is here!"

"Marty" came in and we were introduced. If you have ever noticed, it is exceedingly difficult to form a clear mental picture of someone you love, but I can remember with photographic clarity how Marty looked then, in that instant, standing in the doorway. She is a small woman, and she looked even more diminutive standing next to Mac's six feet four. Her auburn hair was done up in a severe knot which somehow did nothing to detract from her complete femininity: a small heart-shaped face, shining green eyes set wide apart under heavy, almost masculine brows, full lips and a straight nose, a bit too long for perfection perhaps. Altogether a thoroughly beautiful woman, but a woman whose expression—and subsequent words—made you realize that she was used to dealing with men on a level of equality, without being militant about it—a woman whose abilities were such that she had no need to use her obvious good looks and lithe young figure to make her way in a man's world.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Unlike Mac, I am not an inarticulate man. But I stuttered as I acknowledged the introduction. When I could tear my eyes away, I turned questioningly to Ericks to ask him what was up.

He anticipated my question. "Martha Perkins is a Chief Programmer at the Aerospace Center, *and* probably the best programmer in the general field of variant probability in the country. She's part of the 'green box' team."

"The what?" I said.

"Sit down, Pete," said Ericks. "Let me fill you in."

So I sat down, and Ericks—with an occasional assist from Mac or Marty—filled me in. It seems that when my parcel from Mumford Junction got to Mac, he was so excited he couldn't see straight. He'd felt for twenty years that he'd muffed a good chance back in Libya, and it was like having an opportunity to undo a bad error. He set to work immediately on the box, and since he was Chief of Research and Development for his firm, he got all the help and equipment he needed. There was no nonsense with a cutting torch this time. They didn't even risk X-raying the box for fear of setting off the reaction which had destroyed the first one. Instead they did a careful closed-systems check, looking for any sign of input or output, anywhere in the electromagnetic spectrum. They found nothing. Then they bolted the box to an H-34 engine on a test stand with the spur gear meshing with the flywheel, just as it had in Vietnam. No results. They ran the engine up to full power and dropped it back to idle with no discernible effect from the green box, except for the obvious fact that the spur was being driven at a merry clip by the flywheel.

Mac had just about decided that the box was a one-shot affair and that it had had its one shot when he thought of one other test condition. He had the engine trundled into a pressure chamber, evacuated the air to a simulated altitude of a thousand feet and tried the full-power run-up again. This time it took. When he cut the throttle back, engine speed dropped off to a little more than 3,000 RPM and would drop no lower, even under a heavy dynamometer load. Only when the air came whistling back into the chamber, approximating sea-level pressure, did the engine speed drop off to the comfortable idle indicated by the power settings.

"So that was it," continued Ericks. "Mac still didn't know what he had, but he knew what it took to make it perform, and it was enough for him to call for more help."

"Ah figgered it was no job for a country boy like me," chipped in Mac, "so I got on the phone to old Ace here and he come out to Ba-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

kersfield on the next plane. Since then I ain't seen my wife an' kids for more'n about two days, an' we been more hush-hush than a moonshine cooker."

"And what *that* amounts to," added Ericks, "is that we're a project now. Our own funds and our own mission."

"We?" I asked, getting a little of my earlier anger back.

"We," said Ericks emphatically. "Me and Mac and Marty and *you*."

"Now just a minute," I said. "I'm a military officer, not a scientist. Anyway, I've got plans of my own."

Ericks gave me a queer look. "I'm sorry Pete. I know about the War College. But look . . ."

"But look hell!" I said, my anger really showing for the first time. "You've known me long enough to know I won't hold still to be pushed around by you two slide-rulers and Miss Variant Probability of 1964 over here!" The minute I'd said it I was sorry. "I'm sorry, Miss Perkins, I . . . uh . . ." Marty was wearing one of those white lab coats, but it did little to conceal her striking figure. And those green eyes looked genuinely sympathetic, and kind of smoldering, and—let's face it—sexy.

Marty opened her mouth for the first time in a long while. "I know how you must feel, Colonel Albers, and you must hear us out. Hear the rest of the story." She looked at Ericks, and he nodded slightly. "I came into the picture when it was decided to approach the problem of the green box from a causal and motivational point of view."

I looked blank, which was better than the leer I was about to display.

"All that means is that we couldn't find out how the box did what it did, so we decided to try to find out *why* it did what it did. That is, why the box was installed in two aircraft piloted by you, who installed the boxes, what *his* motives were for doing so, and so forth. You see, causality and motivation."

"I see," I said. "You can't figure out what's in this Chinese puzzle, so you're hunting for the Chinaman who put it together in the first place so you can ask *him*."

"Precisely," said Ericks. "And that's where Marty came in. Marty and her pet 2703 computer."

I'm not entirely stupid and I began to see where the explanation was leading. My anger drained away in front of those brilliant green eyes, and I smiled at the idea of Marty having a 2703 as a pet.

"Beauty and the beast, eh?" I said gallantly.

The green eyes twinkled at me. "Oh, I wouldn't call my 2703 exactly beautiful," she said. "Anyway, Colonel Albers, that's where I came in, me and my pet. It was clear from the very modest information we had about the circumstantial existence of the box—apart

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

from its physical nature—that you were an essential element. But statistically, so were B-24s and HU-34s. We ran every scrap of information about the two aircraft, and about you, into the 2703. We poured most of the records of the units to which you were attached during both occurrences into the tank, and then we added what physical information about the green box we had. Then we took the personnel records for all individuals who had had access to the two aircraft, from factory to scrap heap, and fed them to my pet, and for dessert, we sent field investigators to your home town, to your former commanding officers, to everyone we could find who had ever known you well, and we poured a pretty full biography of Colonel Peter Canfield Albers down the 2703's gullet. Then we started asking questions."

"And?" I asked, my voice unpleasant. My mother had written about investigators, but I had assumed it was simply a security check in connection with my assignment to the War College. I didn't like the idea of strangers poking around in my life like this.

"And," said Ericks, "we got a few answers. Just enough to tantalize. We know why you are known throughout the Air Force as 'Lucky Pierre' Albers. You've flown for eighty-five hundred hours, a lot of it in combat, and you've never been scratched."

My irritation grew. "Did it ever occur to you big domes that I might just be a pretty good airplane driver? Isn't that explanation enough?"

"Of course you are, Pete," said Ericks, his voice apologetic. "It's just that in that much flying you're bound to have some close ones, some near accidents. Even commercial airline pilots may experience hundreds of 'near collisions' in the course of a few years flying. But not you. The only times you've come close to piling in—both times—there's been that green box. Do you see why we're interested in every fact about Pete Albers we can find?"

I saw. I'd known my luck was something special, but I guess I'd wanted someone else to say it, someone with some backing, like that hungry 2703 of Marty's. "O.K., Bill, I see your point. Any other answers?"

"A lot of negatives and one positive. The box is clearly not of American manufacture; no one has ever even dreamed of such a device. Obvious, perhaps, but we did a lot of checking just to make sure. Second, it is highly unlikely that the green box is of terrestrial manufacture. From scrapings, Mac determined that the box is made of a very queer metal indeed, a kind of expanded steel with silicon instead of carbon locking the Fe into a molecule that just doesn't exist in nature, and is far beyond anything

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

our technology knows of right now."

My mouth was really open on that one. "Not of terrestrial origin?" I parroted. "You mean it wasn't made here on Earth? But how do you know? Maybe some little guy makes these things for kicks in his basement, some undiscovered genius . . ."

"Ah b'lieve it'd take a helluva lot more'n genius," chimed in Mac. "It'd take pressure, gangs of it. And it'd take heat, like on the order of fusion temperatures. Son, it just ain't in the state of the art, as we say."

I walked over to the window and looked up at the smoky blue of the October sky. "You all are trying to tell me that someone up there likes old lucky Pierre Albers and has gone to great expense and pressure and heat and stuff to save old lucky Pierre's neck on a couple of occasions, and maybe keep him out of trouble on a lot of others."

Nobody said anything. After a few seconds Marty began to nod her head up and down like a solemn child. I wanted to say something smart, or make a wisecrack. But I didn't have it in me. That "not of terrestrial origin" bit had me scared.

After a bit I said: "Bill, you said several negatives and a positive. What did the 2703 deliver on the positive side?"

"A name. Or rather two names. Corporal Frazer Lorenz Thompson and Mr. Edwin Michael Conners. Thompson was assigned as an Aviation Mechanic to the 389th Bomber Group at Benghazi in mid-July 1943. He only signed one payroll there, but there is a record that he was billeted at Benghazi for two weeks in July. Orders transferring him to Blackbushe in England were cut that same month, and he apparently shipped out without attracting any attention."

"July '43," I said. "The Ploesti raid . . ."

Ericks nodded and went on. "Edwin Michael Conners was shipped to Saigon in March 1964 as a civilian technician attached to your squadron. The day of your last flight, he announced to his supervisor that he was quitting, paying his own passage back to the States, and he moved out of his room at the BOQ that night. There is an airline manifest that shows him on a flight from Saigon to Hong Kong on that date. Nothing after that."

"So what's the connection?" I asked.

"According to the FBI—and this is how we got on to it in the first place—Conners and Thompson are the same man, or at least they have the same fingerprints."

"Oh," I said.

"Furthermore, so far as we—or the FBI—can tell, neither man legally exists. There is no record of Thompson, except the paybook with his fingerprint. His enlistment

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

was false, and apparently so were his orders to the 389th BG. Likewise, Conners left prints aplenty in his BOQ—that's where we got 'em, but otherwise no record. His passport, contract with the Army—everything—must have been phony. There is no Edwin Conners matching his description in the United States."

I got up for the beer Marty handed me and stared thoughtfully at the foam for a minute or so. Then Marty said: "Mr. Ericks, tell Colonel Albers about the ages. Maybe he'll have an idea."

"It's simple enough, Pete," said Ericks. "Unlike the case with Thompson, we've been able to talk to quite a few people who remember Conners from Saigon, people whose memories are still fresh. They all agree he couldn't have been more than thirty at the outside. Most estimated his age at around twenty-five."

"B-but," I spluttered, "if he and Thompson are the same guy, Thompson would have to have been, uh, between five and ten years old at Benghazi!"

"Yeah," said Mac dryly, "and ah b'lieve I woulda remembered a ten year old corporal if'n he'd a worked for me then."

Marty's green eyes flashed at me and now it was her quiet smile which was part sympathy, part unconscious sexiness. "We've an idea who our Chinaman is now, Colonel Albers, but he's a puzzle too, isn't he?"

Her question was rhetorical and I didn't bother to answer it. I was too busy absorbing the suddenly confirmed notion that my luck—my unusual, chicken-sandwich luck—was no blind hiccup in the laws of probability, no impersonal cast of the die by one of the Fatal Sisters, but rather the conscious work of a specific individual: Corporal Thompson/Mr. Conners. Who was he? And, *why me?* Bill Ericks seemed to read my mind, to anticipate any unspoken questions.

"So you see why we had to bring you up from the War College, Pete," he said quietly. "The FBI has done everything they could to get a line on this man, and they've not been able to get much of anything. Every lead they've turned up on Conners/Thompson has petered out, and they've admitted confidentially that they don't have much hope of digging up anything more. Now the only opening left to us is you. We can't solve the Chinese puzzle; we can't find the Chinaman; all we can do now is to try to figure out why the Chinaman chose you, and apparently only you, to work his magic on."

"It may not get us anywhere," said Marty, "but you're our last hope." The green eyes were at work again, and my high dudgeon was losing altitude rapidly.

"O.K.! O.K.!" I said. "But I'm just a poor country boy who makes

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

a living driving airplanes and frightening junior officers. How can I help?"

"By letting us get down on tape everything that has ever happened to you, everyone you've ever known," said Marty. "We'll need tape-code descriptions of the minutest details of your life, examples of the writing of all your correspondents, your flight logs, conversations you can remember . . ."

"Now wait a minute . . ." I started. The invasion of privacy all this would entail was putting my ego back into orbit. Then the green eyes attracted my attention and the thought crossed my mind that Marty would be the one who had to tape all this junk, which would mean days and days, if not weeks or months, of more green eyes. And then I thought of the Air Force Undersecretary's initials on my orders, and I thought again of "why me?" and I looked at the green eyes, and my resistance collapsed. My ego went into hibernation for the winter.

"When do we start," I said.

Marty looked questioningly at Ericks, who said: "What's wrong with now?"

So we started in. Not right then, but the next morning. I had to move in first, and send off for the box of personal papers—the detritus of my adult life—which had grown larger and larger with old canceled checks, letters from forgotten friends, memorabilia from a thousand weekends, copies of old orders, college graduation pictures, and a few scented love letters. I'm a lazy man, and it had always seemed easier to ship my collections of personal junk home periodically for storage in my parents' capacious attic than to go to the trouble of sorting through it and purging the vast quantity of useless stuff. Marty was delighted when the boxes arrived, and she put two technicians to work on it right away.

In the meantime, life was not entirely unpleasant. No one at heart really minds talking about himself, and I was doing it ten hours a day. The suite in the Grover was spacious. Besides my living quarters there was a room full of tape-cutting equipment manned by a middleaged woman named Madge who sat from 8:30 in the morning until 5:00 in the evening reducing Marty's handwritten notes to various combinations of holes on paper tapes. Then there was the room in which the technicians worked over the written remains of Pete Albers, sorting and analyzing and occasionally chuckling at some choice bit. It was a real temptation some evenings to flip a lighted cigarette into their room.

There was still another room in which I was subjected to a series of interviews—sometimes with drugs, most of the time without—conducted by a depth-psychologist

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

with heavy black eyebrows growing straight across his forehead. He was a nice enough guy—Dr. Nagy—but I didn't care much for his line of questioning. Even his most innocent questions left me feeling vaguely guilty, as if I were somehow at fault for having benefited from the magic of our mysterious Chinaman. But then when he had pumped me dry—and I really felt that way some evenings—Madge put it all down on tape and I felt better. The little holes punched through the paper seemed to make all that information, some of it deeply personal, impersonal again.

And as the weeks rolled by my prediction to myself about the green eyes came true. Marty began to stay after the others had left, and we got to going out to dinner together. At first I think she felt a little sorry for me, at the opportunity I had been forced to miss, at the ordeal of confession I had to go through. Then it was something else. One cold night just before Christmas she left early, but returned with a bird and a bottle, the second of which we drank and the first she cooked to a golden brown. I won't go into the details of *that* evening, but about a month later she stopped going away at all in the evening, and late in February 1965 we drove to West Virginia and were married by a sleepy Justice of the Peace in Moorefield, just across the Virginia border.

When we got back, by way of Mumford Junction and Cleveland—where Marty's mother lived—Ericks was hopping mad, saying things to Marty about "lack of objectivity" and "the impersonality of scientific endeavor," but she just grinned at him and held my hand a bit tighter, and after he cooled down he offered his congratulations, which weren't at all necessary because we both knew just how lucky we were.

Even operating at high speed, it takes a computer a while to digest so much varied and unconnected information, but old 2703 finally came through. There was a letter from an obscure insurance agency signed in the same handwriting identified as that of "Thompson" in his 1943 paybook. The signature was that of one "Atchison," but the similarity in script was unmistakable, even to me. And thus we had another name for our Chinaman. The letter he had signed was an offer of a twenty-five thousand dollar life insurance policy at a ridiculously low rate, and a canceled check dated in April 1950 showed I had sent him one hundred nineteen dollars and fifty cents for five years' premiums. I was flying in the Air National Guard then and insurance had been hard to get. And while I didn't really need any—no wife and kids—I thought it might be a good idea to leave a little bundle for Mom and Dad if one of those rusty P-51s we were flying then decided it had had the course.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

There had been renewals in '55 and '60 followed by letters bearing the same signature and copies of ornate policies issued by one of the major underwriters and endorsed by the same "H. L. Atchison."

And more than just another name for our Chinaman, we had an address. All correspondence from Atchison had been mailed from Houston, and although I couldn't recall—even under Dr. Nagy's most extreme ministrations—to what address I had written my renewals, enclosing of course the stub of the bill with the address, an FBI check of Houston post offices turned up a box in a branch just off Jensen Road which had been rented under the name H. L. Atchison since 1950. After several days of monumental work, the Bureau located an affable real-estate agent who readily admitted making the quarterly payments for the postoffice box and explained that Atchison had long paid him a handsome retainer for looking after his sparse affairs in Houston and seeing to the rent payments for the modest apartment he had procured for Atchison there. I still have a copy of the Bureau report because I'm still lazy about sorting through my papers and throwing things away:

"SUBJECT (Bureau jargon for the real estate man) asserted that his files reflect the information that T-27 (more FBI jargon for Atchison) first came to him in February 1950 in order to procure a domicile. An apartment satisfactory to T-27 was procured in the Bennington Arms Apartments, 3345 Alamo Road, Houston 6, Texas, and T-27 paid for extensive alterations, explaining to SUBJECT that he desired to redecorate the premises as a shrine to his deceased spouse and had no plans or intentions of living in or otherwise occupying the premises except during occasional visits to Houston, Texas.

"SUBJECT further asserted that T-27 informed him that he was an oil geologist and since he would often be in areas where contact by mail would not be possible, he preferred that SUBJECT handle all his affairs in Houston, Texas, on a five-year basis.

"SUBJECT's deposition (attached) describes his single visit to the above-mentioned premises in the Bennington Arms Apartments, 3345 Alamo Road, Houston 6, Texas, which occurred in April 1950. He avers that his impression of the interior of these premises, while striking him as eccentric, seemed to correspond to the avowed intentions of his client to convert the premises into a religious shrine in memory of the deceased spouse."

"It's obvious," said Ericks, when we had all read the FBI report, "that Thompson/Conners/Atchison—oh hell, let's call him the 'Chinaman'—pulled into Houston

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

and established an address in 1950 with the idea of returning only often enough to handle his insurance business with you, Pete."

"But why?" I asked. "Surely not just to bilk me out of one hundred nineteen dollars and fifty cents every five years."

"And why this funny business with a dead wife?" said Marty. "It's certainly touching, a tribute like that, but somehow it seems more than just eccentric." She cast a speculative green eye at me. "I can't imagine *you* doing anything so sweet, Peter."

"Spouse, if you decease, I have every plan and intention of erecting a shrine to you constructed of heart-shaped memory drums and magnetic tape in the premises located at 2762 Connecticut Avenue N. W., Washington 5, D. C."

"It must be sheer cover," said Ericks, ignoring the horseplay. "Just an excuse for keeping up an uninhabited apartment without arousing suspicion. And it seems to have worked." Ericks pulled his plump bulk up from the couch and walked to the window. "As to why, Pete, suppose we go to Houston and find out."

Our plane was met in Houston by the chief of the local FBI Field Office, a gray little man named Pollock who looked a great deal more like a shoe salesman than an FBI man. He drove us to the address on Alamo Drive, where we were met by a plainclothes cop from the Houston Detective Bureau armed with a search warrant and an immense bundle of keys and lock picks. It was only a moment before he had us out of the glare of a Texas March and into the dry mustiness of the long unoccupied apartment.

The description in the real estate man's deposition had been accurate. The living room was hung about with heavy dark drapes. Except for a broad black buffet and two small chairs in one corner of the room, there was no furniture, but the floor was covered with thick, dark carpeting. Atop the buffet was the faded photograph of a handsome young woman in her twenties, a nondescript woman, beautiful in an impersonal sort of way, the kind of face that smiles up at you from a thousand magazine covers and chewing-gum advertisements. Tall candles stood on either side of the photograph, and the wall behind the buffet was almost covered with a vast clutter of religious ornaments of one sort or another, as if Atchison had gone to one of those shops where they sell plaster crucifixes and cheap reproductions of *The Last Supper* and bought one of everything.

Leading off to the right from this dismal room, a corridor ran first past a small kitchen, dust covered, a rusty streak in the sink, and then past a minuscule bathroom to the stoutly locked door leading to a

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

single bedroom. The detective with the keys and lock picks didn't have so much luck with this one, and he finally resorted to two blasts from his service revolver, a most effective key indeed.

But there was no bed there, and the real estate agent had quite obviously never penetrated that far. A broad bench ran down one side of the room and supported a tangle of electrical wiring and strange looking devices and instruments whose purpose I couldn't even guess. Across the end of the room, crammed into the narrow space, were a precision lathe, a shaper, a drill press, and a small but efficient arc furnace. Thick power cables terminated in a heavy-duty fuse panel mounted on the wall behind the machine tools.

Ericks whistled at the sight. "Mac ought to see this. I bet this is where the green boxes were made."

"Not the first one," I said. "Atchison hasn't had this place that long."

"Yes, of course. He must have had another place before this one. I'll get the Bureau on it."

We went back into the somber shrine. Pollock was methodically sorting through the contents of the black buffet. He handed a fat billfold to Ericks. "Your friend Atchison is pretty careless with his money, whatever else he is. There's something over twenty thousand dollars here." He flipped the card case open. "And look, he's left his driver's license, Social Security card, draft card, and so forth behind him."

I peered over Ericks' pudgy shoulder at the cards. Even to my untrained eyes there could be no doubt: the signatures were familiar and we had definitely found our Chinaman. Ericks stared at the cards, turning the card case over and over in his hand. "I'll bet they're phony," he said finally. Pollock nodded wordlessly, took the proffered case from Ericks and slipped it into his coat pocket. "We'll check," he said.

There was nothing more to be learned. Ericks left instructions with Pollock to keep the apartment under twenty-four hour watch, and we headed back for the airport. On the way Ericks stopped to put in a call to Mac in California, to tell him of our discovery. But Mac was off somewhere in the Pacific Missile Impact Range, and he was not to be reached. But with the apartment under tight surveillance there didn't appear to be any hurry. It could wait, we thought.

Back in Washington, we spent a couple of days, chewing over bits of evidence, trying to put together a cohesive picture of the Chinaman and his motives. But none of it made any sense. We knew who he was and where he had lived from time to time over the past fifteen years, but we still had no answers to any major parts of the mystery. We still didn't know how he had done what

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

he had done. Or why. Or why to *me*.

And I was getting tired of the whole business. I've always been impatient with puzzles and games like chess. I haven't got the patience for it. And I was bored with the inactivity of sitting around Washington waiting for someone else to sort out this particular can of worms. My curiosity itch still needed scratching, but I could live with it, and I was anxious to get back to the War College, to pull Marty away from her work and spend a week or two with her in the little shack I had down at Cape Hatteras where there would be no black-shrouded apartments, no stilted FBI reports, no mysteries except the delightful one of how it was a lanky, balding, forty-two year-old airplane driver, long past thoughts of marriage, could have been so fortunate as to latch on to someone like Marty.

But that was not to be for a while. The FBI had done some more digging and had come up with the fact that the Houston Power and Light Company had recorded sudden increases in power consumption on the transformer leg servicing the Bennington Arms Apartments between the fourth and seventh of April in 1950, 1955, and 1960. In those years I had received my billings from Atchison sometime around the end of April, the time we had figured for a concentrated stakeout if we were to get a glimpse of our Chinaman. Now, however, it looked like a real good bet that he'd be showing up in Houston considerably earlier, sometime in the next week, and a small army of surveillants were ordered into position around the Bennington Arms. On the off-chance that I might be able to spot Atchison—either from my Libyan days or from the more recent period in Vietnam—the Bureau asked that I fly down to join in the watch.

So Ericks and I flew down to Houston again on the second of April. Marty wanted to come along, but she was now pregnant two months with Ethan, and felt too lousy to make the trip. Since it was apparent we might have a long wait, and since Atchison could approach the apartment house from any of four directions—east or west on Alamo, or north or south on Richards—it was decided that I should occupy the apartment itself. We moved a cot into the crowded machine shop—I couldn't bring myself to sleep in that grisly shrine of a bedroom—and I tried to make myself comfortable. Ericks, comfort-loving slob that he is, registered in the Sam Houston, and from the luxury of his room kept in touch with me and the ten or fifteen thousand cops, FBI agents, and boy scouts who seemed to be standing silently around on the street beneath my window. One agent was even disguised as an ice-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

cream vendor, which was all right during the day, although he had to keep shaking his head at disappointed kids, but at night he presented a somewhat implausible figure.

I sat around for two days—the third and fourth of April—reading paperbacks, smoking too many cigarettes, and missing Marty. Now and again my transceiver would crackle a warning, and I would peer carefully out the front windows at some bird who was roughly the same height, build and age we presumed our Chinaman to be. I recognized no one, and none turned into the Bennington Arms and headed for the second floor apartment where I waited. The last of these came a little after midnight on the fourth. I had been long asleep when the buzz and crackle of the transceiver awakened me from dreams of Hatteras. I responded and stumbled down the hall to peer through the shrouded front windows as I had been bid. But the young man who was idling by was no one I recognized and he idled with undiminished slouch on past the building entrance and around the corner on Richards. I yawned mightily and headed on bare feet back toward the bedroom. There was a faint, keening whine behind me and the narrow corridor down which I was padding sleepily was suddenly illuminated with an eerie greenish glow. I came full awake instantly—one of the tricks you learn from dozing on autopilot when a trouble light comes on—and turned back toward the living room to see the damndest thing I have ever seen.

There in the center of that macabre shrine was a bright mass of shimmering light, coalescing into solidity as I watched, and dimming steadily as it coalesced. It was roughly egg-shaped, a couple of yards long and maybe four feet through the middle, like an old model Link trainer without the silly little tail empennage they used to stick on them. But I wasn't thinking of Link trainers. All I could think of was Ericks' theory that the green box was of extraterrestrial origin, and I was scared to death. The quintessence of all the old B movies I'd seen in a hundred ready-rooms, movies with Hollywood electronics, flashes of green lightning, and little green men with big green death-rays went whipping through my mind. Boy, was I scared.

But I didn't run to the transceiver, or jump out the window. My curiosity was itching at maximum ferocity, and despite my better instincts, I edged gingerly into the room and flicked on the overhead lights to counter the gloom that had supplanted the dying fluorescence of the egg. I stood there for maybe thirty seconds, my knees trembling, all kinds of wild thoughts going through my head. I remember thinking, finally, that I might see

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

things more clearly with a cigarette, and I was about to head for the bedroom to get one when a hatchway in the top of the egg snapped inward and the head and shoulders of a dark young man appeared. He had braced both hands on the side of the hatch to hoist himself the rest of the way out before he noticed me. He made a swift motion as if to duck back inside and then caught himself, gave a visible shrug, rose again, and with a single well-muscled movement, pushed himself out of the egg and dropped lightly to the floor. He was naked as a jaybird.

"Hello!" he said, peering intently at me from under heavy dark brows.

I said "Hi."

"Sorry I beed so . . . so—" he indicated his nudity with a wave of the hand. "The probe willn't transmit anything but living protoplasm."

"That's all right," I said. "I used to swim at the YMCA."

He looked mystified at this. I didn't blame him; the conversation was getting pretty inane considering the circumstances. The funny thing was, I recognized him right away. I thought I could remember him from the R & M shack at Benghazi; I was sure I'd had a drink with him once in the Officers' Club in Saigon.

He fumbled in a closet for clothing and I headed for the bedroom and my cigarettes. When I got back I offered him one and lit it for him as he buttoned his shirt. My knees were weak and I sat down in one of the two chairs. When I get good and scared, my first reaction is always a sort of light-headed jolliness. I get flippant and want to crack jokes, I guess to cover up any signs of fear I might show. Then when the initial shock is over I get weak in the knees.

I took a nervous puff on my cigarette. "You, Atchison?" I asked.

"Yo, in a manner of speaking. My real name is Timmons. Ethan Timmons."

I lit a new cigarette from the butt of the old one. "You the guy who saved my bacon at Ploesti and in the chopper last year?"

"Yo. I be the guy." He pronounced "guy" almost like "gooey". I couldn't place the accent. "I haved to protect the insurance company, Colonel Albers." He grinned at this, his eyes wrinkling in good humor, his young face taking on a mischievous, we-share-a-secret look.

"Why?" I asked. "Will you tell me?" I made a wide gesture with my cigarette, sweeping in the egg, the apartment, and my blue pajama'd self.

"Yo, I will tell you. It willn't make any difference. But first you tell me how you finded me."

I told him. About the boxes and Mac, about the FBI work, about Ericks' theory that the boxes were

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

of extraterrestrial origin. I even told him about Mac's plans to inspect the machine shop in the bedroom, and that stopped him for a minute before he grinned and said something about fixing *that*.

When I was done he bummed another cigarette from me and lit it. "Yo. You telled me your story, now I will tell you mine." Then more to himself than to me, "It willn't make any difference. I will have to rerun it all from Saigon on." He rolled his eyes up toward the ceiling, obviously searching for a starting point. He was a very young man and clearly enjoying his role as a revealer of the astonishing.

After a bit he leaned forward in his chair and said: "You, Colonel Albers, be a latent Espy."

"How about that," I said. "Here all this time I thought I was an Episcopalian."

He looked mystified again but went on with his explanation. He was a volatile young man, and from time to time he rose from his chair, borrowed another cigarette, and paced up and down the black carpet alongside the egg, punctuating his words with quick thrusts of the lighted cigarette. He spoke with broad vowels and clipped consonants, somewhat like a Yorkshireman I had served with in Korea. And he had trouble with verbs. "Thought" was "thinked," "ran" was "runned," and so forth.

His story was complicated and I'm not sure even now how much of it I have straight. The essence: Timmons was—is—will be (the tenses get confusing) a time traveler. "Prober" is the word he used. His home time is about a hundred and fifty years from now, 2107 to be precise, and he is one of a group of highly trained men who poke around in the past to do one chore or another, mostly to retrieve objets d'art—paintings, books, curios of one kind or another—which for one reason or another have not survived down to the probers' own time.

He spoke at some length of something he called "temporalmomentum," and while I didn't begin to grasp all his explanation, I gather it involves the problem of just how much the past can be altered without *significantly* affecting the future. As well as I could get it, there was a dividing line, an uncertain and dangerous boundary beyond which the probers dared not pass: little things they did, things which remained unknown or which made no real impact on the public consciousness in the time in question, were swallowed up in the momentum of events and had no significant effect on the future. On the other hand the principle of "for want of a nail the shoe was lost, for want of a shoe . . ." could apply disastrously, and he made his point by asking me to speculate on the results if he were to journey to 1910 Vienna and offer gainful employment to frustrated painter Adolf

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Hitler. "It will'd be, for me and my time, a kind of suicide," he said. "I might still exist, yo. But my times will'd be very different indeed, and I willdn't exist as *me*."

He went on to explain about Espys and Pete Albers' luck. In 2106 there was—will be?—a major military threat against Earth posed by a rapacious horde of beings from without the solar system, the first sentient life detected by man outside his own system. All the resources of Earth and her three struggling planetary colonies had been mobilized to stand off the would-be invaders. At immense cost in men and materiel, the invaders' thrust had been parried, but the invaders themselves lay undamaged just outside the maximum range of Terran weapons systems, and their constant thrusts and probes were quickly exhausting the Earth.

Then, explained Timmons, had come the discovery of *Corticon*, which—if I understood what he was talking about—is some sort of a gizmo for stimulating and tremendously amplifying some sort of psychic force. At first the Corticon was employed simply as a superior guidance system in conjunction with conventional weapons equipped with biological on-board computers—which, I gather, are some sort of doctored-up animal brains—but then they had discovered more or less by accident that a Corticon beam which swept over an invader ship sometimes stimulated it either to mindless apathy or spectacular self-destruction.

But there was a catch in all this: they had been able to turn up only something over two hundred telekinetic adepts—that was Timmons' phrase—in the entire population, and they were simply not enough to give the invaders a decisive blow. However, after a good deal of genealogical research, they had traced a fair number of these adepts —although by no means all—to the offspring of one Harold Gruber Schindhorst, himself not traceable further back than 1916 when he started up in the grocery business in Indianapolis. Schindhorst's sister, Ellen, married Robert Ethan Albers of Mumford Junction, Indiana, and it seemed more than just possible that she had shared her brother's latent Espy potentialities. But the Albers' only child, old lucky Pierre Pete Albers, had died in an airplane crash at Strumica, Yugoslavia, on August 1, 1943, on his return from the Great Ploesti raid of that date. With him, according to Timmons, died some six generations of potential Espys, the genes he might have transmitted to two or three hundred telekinetic adepts—depending upon luck and fecundity—scattered broadly on the fallow soil of Macedonia.

It's an interesting experience to hear your own death described in such matter-of-fact, history-book style. But I don't recommend it. It

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

is unsettling. Still, a lot of pieces began to fall into place, and there was an answer to the question: "But why Pete Albers? Why *me?*" I was sore at first at the thought of all the meddling in my affairs that had gone on. And then I was grateful. I'm glad I didn't die in the Ploesti raid. I wished I could haul out my chromosomes and give them a loving pat. Forty-six good luck pieces, they were.

"So you see, Colonel Albers, I goed back through time to 1943, set up shop in London, and when I had made the power source I goed on to Libya and installed it in your aircraft. Then I comed back to 1950, getted this dwelling as a base, and comed on up to 1980, stopping off every five years to mail you a bill for your insurance. Back I goed again to 1950 about three weeks after I mailed the first bill, and I comed up again every five years and looked for the answers. No one hundred nineteen dollars and fifty, no Peter Albers, and I had to go all the way out to Mumford Junction, find out what happened, where, when and how you'd beed killed. Then I had to do something about it. Rupture a hydraulic line, get the brakes repaired on your old MG, or install another power source. Each time, then, I comed up to the next five-year check to see if a letter from you will'd indicate that the steps I had tooked had beed effective." He sighed deeply. "You've beed a problem, Colonel."

"Sorry," I said. "I'll try to be more careful in the future."

"No. It been't that." There was a faint blush high on his young forehead. "I don't want to get personal, Colonel, but I have beed working on your case for almost four months now, and it beed just wasted effort if you doon't . . . ah—" He stopped in embarrassment and then tried a different tack. "Colonel, I keep waiting for you to change the beneficiary of your insurance policy from your parents to a wife." Then, impatiently, "I can keep you alive, Colonel, but I can't make you marry, *and we need those genes!*"

"Take 'em," I said. "They're yours." I was overcome with reaction to the strange evening. And to the humor of my position. I began to chuckle uncontrollably.

Timmons, of course, didn't see the humor. "Colonel, this beed deadly serious to me. While I will erase any trace of this evening's conversation by going back to Saigon, tell me now if we be wasting our hopes on you." He leaned forward, the flush on his forehead spreading downward to his cheeks. "Tell me, Colonel, be you a homosexual?"

At this question, which I would normally answer with a dose of knuckles, I could contain myself no longer and laughed uncontrollably. "Timmons," I chortled, "relax. I was married almost three months ago and my wife is pregnant."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

A broad grin replaced the blush of embarrassment and anger on the young man's face. "Wonderful, Colonel. Congratulations! Wonderful! There be nothing left, then, but to get back to Saigon and erase this unfortunate business. I wish you long life, sir, and"—his voice dropping into sincerity—"best wishes to you in your marriage."

"Back to Saigon?" I said. "Erase *what* business?"

"No cause for alarm, Colonel. It be the law of temporal momentum. With all you know now, and all that your friends Ericks and Mcdougal know, or soon will—well, I can't take the chance. If a wide circle of people beed to learn the existence of time-probing, that alone will'd produce significant change. And then there beed all that your friend Mcdougal can'd get out of the shop back there." He nodded toward the bedroom.

"I'll never tell," I said. "And I like the things the way they are."

Timmons started to take his clothes off, hanging each piece carefully back in the closet for use five years hence. "I will'd like to take your word for it," he said, "but I can't take the chance." He smiled brightly at me from the far side of the egg. "Anyway, it willn't hurt a bit. We'll just wipe out the last . . . let me see . . . eleven months. I'll find a better way to get you out of that helicopter over the Mekong, and you, of course, will never know the difference."

"But wait a minute," I said. "I'll keep quiet and Ericks and Mac will shut up, too. Mac hasn't made any headway with the green box, and Ericks has no proof for his theories. Anyway, they're the wrong theories. He thinks you're some man from Mars."

"Can't take the chance," said Timmons stubbornly. "Try to understand, Colonel. I have to do it. And doon't worry, you'll never know."

Maybe he was right, I guess he was. I would never know, and what you don't know never hurts you. But maybe that was the trouble. All the Indiana hick stubbornness welled up in me. I *liked* things the way they were. Sure, I was grateful that my bacon had been saved a number of times in the past—how often I still have no idea—but I do like to think I'm the master of my own fate and the captain of my own soul, and I couldn't bear the idea of this young squirt zipping around time, altering things that had already happened to me, "erasing" everything that had happened in the last eleven months.

And then it hit me. Martha! *My Lord I wouldn't meet Martha!*

Timmons was once again nude and he had both legs in the egg, about to lower himself in. "Wait! Timmons," I shouted. "You've forgotten something!"

He paused. "What?"

"My wife! I met my wife on the green box project! You cancel out

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the last eleven months and you cancel out my marriage!"

His face whitened and he froze in the hatchway. You could almost hear the wheel spinning in his head, and I knew I had him. In a mixture of panic and exultation, I drove the lance deeper. "Genes! Timmons, Genes! No wife, no genes! At least none that'll do you any good. Come on back out, Timmons! I'm forty-two, Timmons, and a man forty-two doesn't have many opportunities to marry!"

Timmons pulled himself up and sat on the egg, his legs dangling into the open hatch. "Yo," he said. And then he was silent for a time, calculating. I was beginning to estimate my chances for clobbering him when he swung down to the carpet and headed for the bedroom. He had twenty pounds and the best part of twenty years on me, and I decided my chances were slim. Instead I followed him down the hall.

Over his shoulder he asked: "When do you expect your friend Mcdougal?"

"Sometime in the next couple of days. Not before day after tomorrow."

He did something to one of the thick cables feeding the apparatus on the long bench. "What time be it now?" he asked, his hands very busy.

I looked at my watch. "Four twenty-seven."

He finished whatever he was doing and I trailed him back into the living room. "You'd better be out of that room," he said, hoisting himself back into the egg, "by twelve twenty-seven tomorrow. It willn't be very violent, but there might be some flying glass." With just his head and shoulders protruding from the egg, he turned for a last look at me. "Yo, Colonel Albers. It be a stand-off, and we'll give it a try. I will find a new place for my shop, and your friend Mcdougal will get nowhere with the green box without this shop." He lowered himself a bit further. "Doon't forget one thing, Colonel Albers."

"Yo?" I said politely.

"Doon't forget to forget all this. I'll be around from time to time to check up."

"I'll keep quiet." I said. "But don't you forget."

"What?" he said, his voice muffled by the closing hatch.

"Genes! Timmons, Genes!" I shouted. And then there was the green phosphorescence and the whine, and nothing at all. I went back to bed.

At seven-thirty, the transceiver buzzed and crackled and I got up to peek out at a young, dark-haired meter-reader trying to buy a popsicle from the FBI man in the Good Humor truck.

And so, boys, you now know why I've left you this rather long account of some matters that occurred before you were born. As I write this I have no idea how much

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

longer I will be around. I will be careful, though, and not depend very much on my luck. The fact that you three are healthy, lively youngsters—I hear you, Timmy, shouting for that last glass of water that is always the youngest's prerogative—would suggest to me that Timmons is not going to be overly concerned about *my* welfare from now on. However, he *is* going to be concerned about yours. And could any father ask more?

Maybe this will reach you when you, too, are middle-aged and graying. I hope so. Maybe some lawyer —or your mother—will hand it to each of you when you reach twenty-one. However it happens, keep the contents to yourselves. No one would believe the story anyway. But if you want to prove it to yourselves, get a couple of small pith balls, put them on a smooth surface, concentrate as hard as you can, and *will* them to move. It's the best proof I can offer, but there is something else. Look back in my household files to this month, April 1970. You'll find a carbon of my last letter to Mr. Atchison. It reads:

Dear Mr. Atchison;

Inclosed please find my check for $119.50 for another five years premium.

I don't know why I bother. After all, who needs insurance?

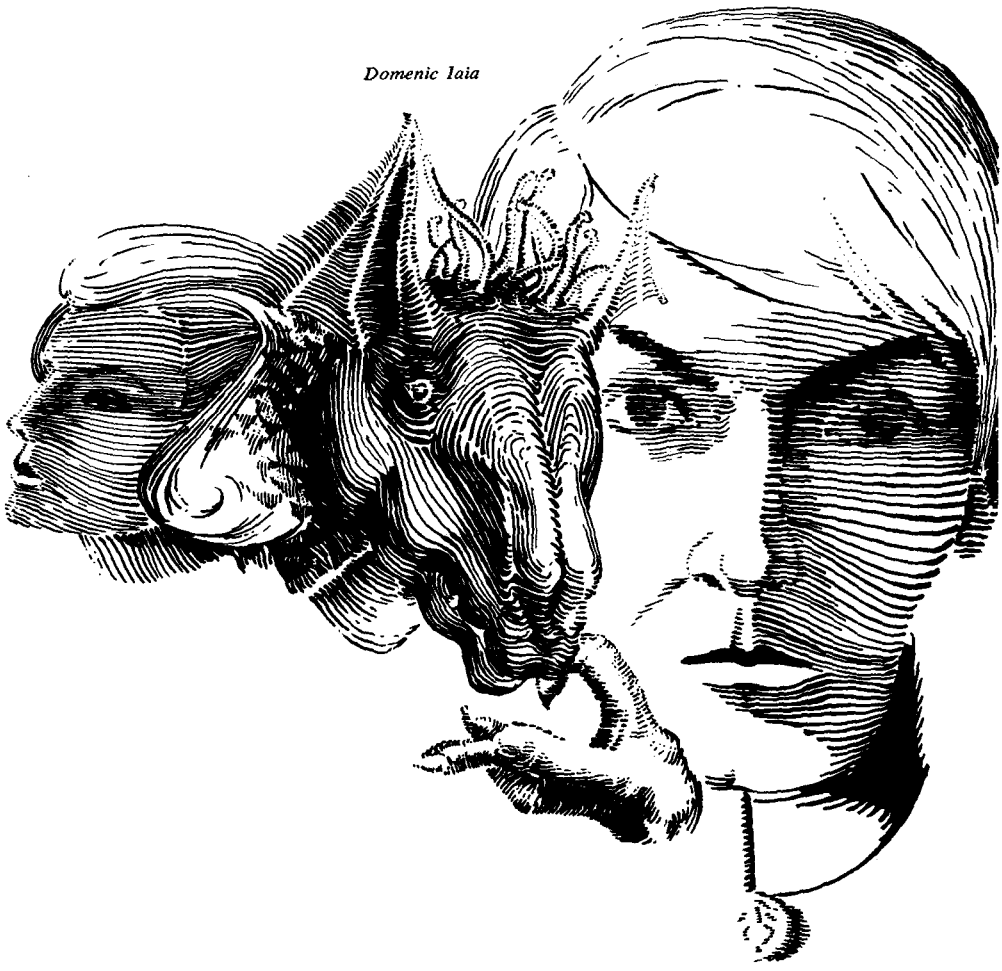
Peter L. Albers, Brig. USAF.

IN TIMES TO COME

It's been some time since we heard from Paul Ash—a professional zoologist is apt to spend large quantities of time in areas of the world where writing is not really convenient—but we have another story. Coming up next issue is "The Wings of a Bat," by Paul Ash. The wings in the story, however, are definitely not bat wings; they're *pteranodon* wings. And the story—well, it's a little difficult to say it's not laid in the future, yet it definitely takes place in the multi-hundred-megayears past. But the take-off point—it being a matter of time travel—is in the future.

Most of the mineral resources we have available are simply those that geological weathering has exposed. A hundred megayears ago, weathering had exposed resources that have, of course, long since been weathered away entirely, while our present resources were too deeply buried for access. So . . . deposits of Then could be exploited without affecting Now . . . maybe . . . ■ THE EDITOR

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



Domenic Iaia

Normally, one would think that something as large as a planetary system, with a stupendous hydrogen-fusion thermonuclear reactor blazing away would be a bit hard to hide. But there's nothing too big for a completely accepted theory to hide!

A Sun Invisible | Poul Anderson

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The invaders had deployed their fleet in standard patrol orbits. Otherwise they did nothing to camouflage themselves. It bespoke a confidence that chilled David Falkayn.

As his speedster neared Vanessa, he picked up ship after ship on his instruments. One passed so close that his viewscreens needed little magnification to show details. She was a giant, of Nova class, with only subtle outward indications that the hands which built her were not human. Her guns thrust across blackness and crowding constellations; sunlight blazed off her flanks; she was beautiful, arrogant, and terrifying.

Falkayn told himself he was not duly terrified. Himself wondered how big a liar he was.

His receiver buzzed, a call on the universal band. He flipped to Accept. The dial on the Doppler compensator indicated that the battleship was rapidly matching vectors with him. The image which looked out of the screen was—no, scarcely that of a Vanessan, but a member of the same species. It gabbled.

"Sorry, no spikka da—" Falkayn braked. Conquerors were apt to be touchy, and yonder chap sat aboard a vessel which could eat a continent with nuclear weapons and use his boat afterward for a toothpick. "I regret my ignorance of your various languages."

The Kraok honked. Evidently he, she, or yx did not know Anglic. Well, the interspeech of the Polesotechnic League . . . *"Loquerisne Latine?"*

The being reached for a vocalizer. Without such help, humans and Kraoka garbled each other's sounds rather badly. Adjusting it, the officer asked, *"Sprechen Sie Deutsch?"*

"Huh?" Falkayn's jaw hit his Adam's apple.

"Ich haben die Deutsche Sprache ein wenig gelehrt," said the Kraok with more pride than grammar, *"bein der grosse Kapitän."*

Falkayn gripped tight to his pilot seat, and his sanity, and gaped.

Aside from being hostile, the creature was not an unpleasing sight. About two meters tall, the body resembled that of a slim tyrannosaur, if one can imagine tyrannosaurs with brown fur. From the back sprang a great, ribbed dorsal fin,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

partly folded but still shimmering iridescent. The arms were quite anthropoid, except for four-fingered hands where each digit had an extra joint. The head was round, with tufted ears, blunt muzzle, eyes smaller than a man's.

Clothing amounted to a brassard of authority, a pouchbelt, and a sidearm. Falkayn, therefore, could search his memory and discover which of the three Kraokan sexes the officer belonged to: the so-called transmitter, which was fertilized by the male and in turn impregnated the female. *I should've guessed,* he thought, *even if the library on Garstang's didn't have much information on them. The males are short and meek, and raise the young. The females are the most creative and make most of the decisions. The transmitters are the most belligerent.*

And right now are tracking me with guns. He felt altogether isolated. The throb and murmur of the boat, the odors of recycled air and his own sweat, his weight under the interior G-field, were like an eggshell of life-sensation around him. Outside lay starkness. The power of the League was distant by multiple parsecs, and these strangers had declared themselves its enemies.

"*Antworten Sie!*" demanded the Kraok.

Falkayn groped with half-forgotten bits of Yiddish that he had sometimes heard from old Martin Schuster, his master during his apprenticeship. "*Ikh . . . veyss . . . nit keyn . . . Deitch,*" he said, as slowly and clearly as possible. "Get me . . . *ah mentsch* . . . uh, *zeit azay git.*" The other sat motionless. "Damn it, you've got humans with you," Falkayn said. "I know the name of one. Utah Horn. Understand? Utah Horn."

The Kraok switched him over to another, who squatted against a background of electronic apparatus. Unhuman tones whistled from an intercom. The new one turned to Falkayn.

"I know some Latin," yx said. In spite of a vocalizer, the accent was thick enough to spread on pumpernickel. "You identify."

Falkayn wet his lips. "I am the Polesotechnic League's factor on Garstang's," he said. "A messenger capsule brought me word about your, uh, advent. It said I had permission to come here."

"So." More whistles. "Indeed. One boat, unarmed, we allow to make landing at Elan-Trrl. You make trouble, we kill."

"Of course I won't," Falkayn promised, *unless I get a chance.* "I will proceed directly. Do you want my route plan?"

Yx did. The boat's pilot computer sent numbers to the battleship's. The track was approved. Maser beams flashed through space, alerting other vessels to keep an eye on the speedster. "You go," said the Kraok.

"But this Utah Horn—"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Commander Horn see you when want to. Go." The screen blanked and Falkayn went. The acceleration strained his internal field compensators.

He gusted air from his lungs and stared outward. Hitherto, as he sped toward Thurman's Star, the view had been dominated by Beta Centauri, unwinking, almost intolerably brilliant across two-score light-years. But now the sun of Vanessa showed a visible disk. It wasn't that kind of type B supergiant but nevertheless impressive, a white F_5, seething with prominences, shimmering with corona. If his shield screens should fail, its radiation would strike through the hull and destroy him.

Well, he gulped, *I wanted to be a dashing adventurer. So here I am, and mostly I want to dash.*

He stretched, opposed muscles to each other, worked out some of his tension. Then he felt hungry, and went aft to build a sandwich; and when he had eaten and lit his pipe, a certain ebullience returned. For he was a bare twenty years old.

When he got his journeyman's papers, he was one of the youngest humans ever to do so. In large part, that was thanks to his role in the trouble on Ivanhoe. To set a similar record for a Master Merchant's certificate, he needed another exploit or two. Beljagor's message had made him whoop for glee.

Now it turned out that he was up against something more formidable than he had imagined. But he remained a scion of a baronial house in the Grand Duchy of Hermes. Mustn't let the side down, eh, what?

At a minimum, if he did nothing but convey word to Sector HQ about what had happened, that would bring him to the notice of the higher-ups. Maybe old Nick van Rijn himself would hear about this David Falkayn, who was so obviously being wasted in that dismal little outpost on Garstang's.

He practiced a reckless grin. It looked better than last year. While his face remained incurably snub-nosed, it had lost the chubbiness that used to distress him. And he was large and blond and rangy, he told himself, and had excellent taste in clothes and wine. Also women, he added, becoming more smug by the minute. If only he weren't the sole human on his assigned planet—Well, perhaps this mysterious Horn person had brought along some spare females . . .

Vanessa grew in the vision ports, a reddish globe mottled with green and blue, sparked with reflections off the small seas. Falkayn wondered what the inhabitants called it. Being colonists themselves, whose civilization had not fallen apart during the long hiatus in Kraokan space travel as had happened on other settlements, they doubtless had a single language. Why hadn't Thurman done the usual thing in such cases, and put the native name of his discovery into the catalogues?

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Quite probably because men couldn't wrap their larynxes around it. Or maybe he just felt like dubbing the planet "Vanessa." Judas, what a radium-plated opportunity an explorer had! What girl could possibly resist an offer to name a whole world for her?

Another warship in sentry orbit became discernible. Falkayn stopped daydreaming.

In the lost great days of their expansion, the Kraoka had never founded a city. The concept of so small a unit having an identity of its own—and composed of still lesser individual sub-units, each with *its* separateness—was too alien to them. However, they did give names to the interconnected warrens they built at various sites. Falkayn's Bible—"Terrestrial Pilot's Guide to the Beta Centauri Region"—informed him that Elan-Trrl, in any of several possible spellings, could be found in the middle northern latitudes and was marked by a League radio beacon.

So crowded a microreel could say little about the planet. The only important hazards mentioned were ozone and ultraviolet. He got into a hooded coverall and donned a filter mask with goggles. The tiny spaceport swooped up at him. He landed and debarked.

For a moment he stood orienting himself, getting accustomed to strangeness. The sky overhead was cloudless, very pale blue, the sun too dazzling for him to look near. Colors seemed washed out in that cruel illumination. Beyond the port, hills rolled down to a lake from which irrigation canals seamed a landscape densely cultivated in bluish-green shrubs. Gnarled, feathery-leaved trees grew along the canal banks and high-prowed motorboats glided on the water. The agricultural machines in the fields, and the occasional gravity craft that flitted overhead, must have been imported by League traders. On the horizon there bulked a dry brown mountain range.

Falkayn felt heavy, under the pull of one-point-two G's. A wind boomed around him, casting billows of heat. But in this parched air he wasn't grossly uncomfortable.

On the other side of the port, Elan-Trrl lifted bulbous towers. Their gray stone was blurred in outline, from millennia of weathering. He didn't see much traffic; mainly underground, he believed. His eyes went gratefully to the homelike steel-and-vitryl facades of the League compound at the edge of the spacefield. They wavered in the heat shimmers.

Two vessels rested near his. One was a stubby Holbert, evidently Beljagor's; the second, lean and armed, modeled after a Terrestrial chaser, must belong to the invaders. Several Kraoka stood guard in her shade. They must have been told to expect Falkayn, for they made no move toward him. Nor did they speak. As

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

he walked to the compound, he felt their eyes bore at his back. His boots made a loud, lonely noise beneath the wind.

The door of the factor's quarters opened for him. The air in the lobby was no less hot and sere than outside, the light scarcely less harsh. But naturally the League would put someone from an F-type star here. Falkayn began to think more kindly about cool green Garstang's. And why hadn't this Beljagor unko come out to meet him?

An intercom said, "Down the hall to your right," in Latin and a gravelly bass.

Falkayn proceeded to the main office. Beljagor sat behind his desk, puffing a cigar. Above him hung the emblem of the Polesotechnic League, an early Caravel spaceship on a sunburst and the motto *All The Traffic Will Bear*. Computers, vocascribes, and other equipment were familiar, too. The boss was not. Falkayn had never met anyone from Jaleel before.

"So there you are," Beljagor said. "Took you long enough."

Falkayn stopped and looked at him. The factor was somewhat anthropoid. That is, his stocky form sported two legs, two arms, one head, and no tail. But he was little over a meter tall; his feet each had three thick toes, his hands three mutually opposed fingers; the kilt which was his solitary garment revealed gray scales and yellow abdomen. His nose could best be likened to a tapir's snout, his ears to a sort of bat wings. A bunch of carrotty cilia sprouted from the top of his pate, a pair of fleshy chemosensor tendrils from above his eyes. Those eyes were as small as a Kraok's; animals which see a ways into the ultraviolet and don't use the red end of man's spectrum have no need for large orbs.

As if for comparison, a Vanessan squatted on yxs—no, her, this time —tail before the desk. Beljagor gestured with his cigar. "This here is Quillipup, my chief liaison officer. And you are . . . what is your silly name, now?"

"David Falkayn!" The newcomer could do nothing but snap a bit, when he was a mere journeyman face to face with a Master.

"Well, sit. Have a beer? You Earthtypes dehydrate easy."

Falkayn decided Beljagor wasn't such a bad fellow after all. "Thank you, sir." He folded his lean frame into a lounger.

The Jaleelan ordered through his intercom. "Have any trouble on your way?" he asked.

"No."

"I didn't expect you would. You're not worth bothering with. Also, Horn wanted you to come, and he seems to rank high in their fleet." Beljagor shrugged. "Can't say I wanted you myself. An unlicked cub! If there'd been an experienced man anywhere nearby, we might have got something done."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Falkayn swallowed another chunk of pride. "Regrets, sir. But when the League has only been operating hereabouts for a few decades—I'm not sure what you have in mind. Your message just said the Thurmanian System had been invaded by a force of Kraoka who're ordering the League out of the whole Beta Centauri region."

"Well, somebody has to go warn HQ," Beljagor grunted, "and I won't myself. That is, I figure to stay here and stall, maybe even argue them into changing their minds. Your own post won't miss *you*." He fumed in silence for a while. "First, though, before you leave, I want you to try and make a few elementary observations. That's why I sent to Garstang's for help, instead of Roxlatl. Snarfen is probably ten times as able as you—he being a Master—but you are a human and there are humans in high positions among the Antoranites. Like Utah Horn, who said he'd want to interview you, after I mentioned your origin. So maybe you can get a line on what's going on. Takes one member of your ridiculous race to understand another, I always say."

Falkayn stuck grimly to the point. "The Antoranites . . . sir?"

"The invaders call their base Antoran. They won't describe it beyond the name."

Falkayn glanced at Quillipup. "Don't you have some idea where they come from?" he asked.

"No," said the Kraok into her vocalizer. "It can be no world that the Race was known to have settled. But records are incomplete."

"I don't understand how—"

"I shall explain. Ages before your species or Master Beljagor's were aught but savages, our great ancestors on Kraokanan—"

"Yes, I know about them."

"Don't interrupt your superiors, cub," Beljagor growled. "Besides, I'm not sure you do know the history. And won't hurt you to hear it again, whether or not you've waded through a book or two." His nose twitched in disdain. "You're with Solar Spice & Liquors, right? They don't deal here. Nothing for them. As far as interstellar trade goes, Vanessa doesn't produce anything but drugs and fluorescents that aren't useful to your type of life. Me, I'm not only here as agent for General Motors of Jaleel, I often represent other companies from similar planets. So I have to know the situation inside out. Go on, Quillipup."

"Now you are interrupting," sulked the Vanessan.

"When I speak, it is not an interruption, it's an enlightenment. Go on, I said. But make it short. None of your singing chronicles, you hear?"

"The majesty of the Race cannot well be conveyed without the Triumph Ballads."

"Stuff the majesty of the Race! Carry on."

"Oh, well, he probably could not

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

appreciate the splendor anyway."

Falkayn gritted his teeth. Where the hell was that promised beer?

"Thousands upon thousand of years ago, then," Quillipup quietly began, "the Race mastered space flight and set forth to colonize among the stars. Long and mighty was that striving, and the tales of the hero-crews echo down the ages. As for example, Ungn—"

"Vector back," ordered Beljagor, for Quillipup seemed about to burst into song.

Falkayn wondered if her bragging was due to an inferiority complex. The fact of the matter was that the Kraoka never had learned how to build a hyperdrive engine. Everything must be done at sublight speeds: decades or centuries, from star to star. And then only the bright F-types, which are comparatively rare, were reasonable goals. Smaller suns, like Sol, were too cool and dim, too poor in the ultraviolet radiation on which a high-energy biochemistry depended. Bigger ones like Beta Centauri—indeed, any above F_5 in the main sequence—lacked planets. The Kraoka were lucky to have found fourteen new systems they could use.

"Try to imagine the ancestral achievement," Quillipup urged. "Not merely did they cross the unthinkable interstellar abysses, they often transformed the atmosphere and ecology of entire worlds, to make them habitable. Never another species has gained the skill in that art which they possessed."

Well, naturally not, Falkayn thought. Modern spacefarers had no reason to be planetary engineers. If they didn't like a globe, they flitted off to look for another. Sublight travelers could not be so choosy.

He must admit that the Kraokan past had a certain grandeur. Men would hardly have mounted so vast a project for so long; they had more individual but less racial pride.

"When the Dark Ages descended," Quillipup said, "we remembered. Whatever else slipped from our grasp, we were yet able to look into the night sky and know what stars shone upon our kindred."

According to what Falkayn had read, the collapse had been gradual but inevitable. The sphere of operations simply became too big for expeditions so slow; it grew too costly, in time and labor and resources, to attain the next white sun. Thus exploration ended.

And likewise did trade between the colonies. It couldn't be made to pay. The Polesotechnic League exists merely because—given hyperdrive and gravity control—interstellar freight costs less for numberless planetary products than manufacture at home would cost. Though the ancient Kraoka had lacked a profit motive, they were not exempt from the laws of economics.

So they built no more star ships.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

In time, most of the colonies even quit interplanetary travel. Several fell into chaos and ultimate barbarism. Vanessa was luckier: civilization persisted, ossified and changeless but on a fairly high technological level, for some three hundred centuries. Then Thurman came. And now the Kraoka again had news from their lost brothers, and dreamed of reunifying the Race.

Which required money. A spaceship is not exactly cheap, and the League is no charitable organization. Let the Vanessans accumulate sufficient credit, and shipyards elsewhere in the galaxy would be glad to take their orders. But not before.

Falkayn grew aware that Quillipup was droning on about more immediately significant business.

". . . Neither chronicle nor tradition identifies a world that might be Antoran. Phonetic analysis of clandestinely recorded speech, and certain details of custom that have been observed, suggest that the planet was settled from Dzua. But Dzua was one of the first worlds on which civilization disintegrated, and no record remains of enterprises which might once have begun there. Antoran must, accordingly, be a fifteenth colony, forgotten at home and never mentioned to the rest of us."

"Are you sure?" Falkayn ventured. "I mean, could one of the known Kraokan planets not—"

"Certainly not," Beljagor said. "I've been on all of them and I know their capabilities. A fleet like this one—and I was taken into space, shown how big a fleet it s and what it can do—can't be built without more industry than anybody could hide."

"The invaders . . . what have they said?"

"Not a clue-giving word, I told you. They don't belong to your blabbermouth species. Kraoka have too much tribal-identity instinct to break security."

"They must at least have explained their reasons."

"Oh, that. Yes. They're hell-bent to reestablish the old society, as an empire this time. And they want the League out of the entire region because they say we're a bunch of dominators, exploiters, corrupters of the pure tradition, and I don't know what stinking else."

Falkayn stole a look at Quillipup. He couldn't read expressions on her face, but the dorsal fin—a body-cooling surface—was erecting itself and the tail switched. Vanessa had offered no resistance to the takeover. Quite probably Quillipup would not be a bit sorry if her present employers got booted out.

The human said carefully, "Well, sir, in a way they're justified, aren't they? This is their home, not ours. We've done nothing for the Kraoka that we didn't make a fat profit on. And if they want to deal with us, they have to change a high, ancient culture—"

"Your idealism pierces me to the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

core; I won't say in what parts of my anatomy," Beljagor sneered. "What matters is that the League stands to lose a megawhopping amount of money. All our facilities in the region are to be confiscated, you hear? So they'll get our trade with the cooler stars, too. And I don't think they'll stop there, either. Those humans who're with them, what do *they* want?"

"Well . . . yes," Falkayn conceded. There was no denying that his own species was among the most predatory in the universe. "Your message mentioned somebody called Utah Horn. That does sound pretty, uh, Wild West and bandit-like."

"I'll notify him you're here," Beljagor said. "He wants to talk with a League official of his own race. Well, he'll have to settle for you. I wish I could hope you'll manage to worm something out of him."

A servor floated in with bottles. "Here's the beer," Beljagor announced. The machine opened two, Quillipup curtly declining a third. Her sinews were taut and her tail lashed the clawed feet.

"Ad fortunam tuam." Beljagor said with no great sincerity, and tossed off half a liter.

Falkayn opened his mask at the mouth and did the same. Then he spouted the liquid back, choked, coughed, and fought not to vomit.

"Huh?" Beljagor stared. "What in the nine pustulant hells—? Oh. I see. I forgot your breed can't stand Jaleelan proteins." He slapped his thigh with a pistol noise. "Haw, haw, haw!"

Humans being as ubiquitous as they are, nearly every League outpost on a nonterrestroid planet includes a suite conditioned and stocked for such visitors. Falkayn had been afraid that those Antoranite officers who were of his lineage would have taken the quarters over, leaving him to twiddle his thumbs in the cramped speedster. But they preferred their spaceships, he learned. Perhaps they were wary of booby traps. He was free to twiddle his thumbs in a series of rooms.

His phone chimed as Vanessa's nineteen-hour day was drawing to a close. A man in a form-fitting green uniform looked out of the screen. His features were hard, moustached, and so deeply tanned that at first Falkayn took him for an African. "You are the one from the other Polesotechnic station?" he asked. He spoke coldly, with a guttural accent.

"Yes. David Falkayn. And you're Commander Horn?"

"No. Captain Blanck, in charge of Security. Since Commander Horn is to have a conference with you, I am making safe arrangements."

"I'm not quite sure what we are to confer about."

Blanck cracked a smile. It seemed to hurt his face. "Nothing very definite, Freeman Falkayn. We wish

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

certain messages conveyed by you to the League. Otherwise, shall we say that it is mutually advantageous to get some personal impressions of each other, uncomplicated by inherent differences between species. Antoran will fight if need be, but would rather not. Commander Horn wishes to persuade you that we are no monsters, nor engaged in an unreasonable cause. It is hoped that you in turn can convince your superiors."

"Um-m-m . . . O.K. Where and when?"

"I think best in your billet. We assume you are not so stupid as to attempt any breach of truce."

"With a war fleet sitting right over my head? Don't worry!" Falkayn considered. "How about dinner here? I've checked the supplies, and they're better than anything a spaceship is likely to have."

Blanck agreed, set the time for an hour hence, and switched off. Falkayn got the kitchen servors busy. The fact that he was to dine with an enemy did not mean he couldn't dine well. Of course, a space cowboy like Utah Horn wouldn't know caviar from buckshot; but Falkayn was prepared to savor for two.

While he dressed, in a formal gold outfit, he lined up his thoughts. There didn't seem to be many humans with the invaders, but they all seemed to be key personnel. No doubt they were the ones who had originally shown the Antoranites how to build warcraft, and were the experienced strategists and tacticians of the whole shebang. Horn was willing to come here because a fellow human taken aboard a ship might observe too much, critical little details which would have escaped Beljagor. But Falkayn could try to pump him . . .

A tender landed from the orbiting flotilla. Dusk had fallen, and Falkayn could barely see that a single human walked toward his lodgings, accompanied by four Kraokan guards. Those took stations at the entrance.

A minute passed while his guest waited in the air lock for ozone to be converted; then Falkayn activated the inner door. The Antoranite had just hung up a filter mask. Falkayn lurched.

"What?" he yelled.

She couldn't be many years older than himself. The uniform was snug around a figure which would have stunned him even if he had not been celibate for months. Blue-black hair fell softly to her shoulders past enormous hazel eyes, tip-tilted nose, the most delightful mouth he had ever—

She turned Blanck's accent to music. "Freeman Falkayn? I am Commander Horn."

"*Utah* Horn?"

"Yes, that is correct, Jutta Horn of Neuheim. You are surprised?"

Falkayn nodded in a blackjacked fashion.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"You see, Neuheim's population being small, any who happen to have some ability must help. Besides, my father was the man who discovered the lost planet and began this whole crusade. The Kraoka, with their feeling for ancestry, revere me on that account; and moreover, they are used to thinking of females as leaders. So I am doubly useful; any orders transmitted by me are sure to be obeyed to the letter. You must have met women spacers before now."

"Uh, it's only that, uh—" *I get it. When he dictated his letter to me, Beljagor was using a 'scribe adjusted for Anglic spelling. Quite understandable, when so few people speak German any more. He did use the masculine pronoun for her. But either he didn't happen to meet her personally, or he's too contemptuous of humans to bother noticing their sex.*

The loss is entirely his.

Falkayn collected himself, smiled his largest smile and bowed his most sweeping bow. "I wish I could be so pleasantly surprised every time," he purred. "Welcome, Commander. Do sit down. What would you like to drink?"

She looked doubtful. "I am not sure if I ought."

"Come, come. A dinner without an aperitif is like a . . . ahem! . . . a day without sunshine."

"*Ach*, I am not familiar with these things."

"High time you became so, then." Falkayn told the nearest servor to bring old-fashioneds. He preferred a martini himself, by several light-years, but if her palate was uneducated she'd drink more of something sweet.

She settled primly on a chair. He saw that her wrist communicator was energized, doubtless transmitting to the guards outside. If they heard anything suspicious, they would break in. Still, they wouldn't catch the nuances of what Falkayn was feverishly planning.

He sat down, too. She refused a cigarette. "You must not have had a chance to be corrupted by civilization," he laughed.

"No," she agreed, deadpan. "I was born and raised on Neuheim. My sole visits beyond the system, until now, were to unexplored stars in the course of training cruises."

"What is this Neuheim?"

"Our planet. A part of the Antoranite System."

"Eh? You mean Antoran is a star?"

Jutta Horn bit her lip. "I did not know you had the opposite impression."

In spite of her nearness, or maybe because of being stimulated thereby, Falkayn's mind leaped. "Ah-ha!" he grinned. "This tells me something. We took for granted that the Antoranites were from a single planet and their human allies simply adventurers. Earthmen don't call themselves Solarians. But Earthmen and Martians do collec-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

tively. Ergo, there's more than one inhabited planet going around Antoran. Your Neuheim; and how many Kraokan worlds?"

"No matter!" she clipped.

He waved his hand. "I'm sorry if I've disturbed you. Here are our cocktails. Let's drink to a better understanding between us."

She sipped, hesitantly at first, then with frank enjoyment. "You are more friendly than I had expected," she said.

"How could I be otherwise toward you, my lady?" She blushed and fluttered her lashes, yet obviously she was not playing coquette. He eased off; never embarrass your target. "We're discussing our differences like two civilized people, trying to reach a compromise. Aren't we?"

"What authority have you to sign treaties?" She might never have been in civilization, but she had been taught how it worked.

"None," Falkayn said. "As the man on the spot, though, I can make recommendations that will have considerable weight."

"You look so young to be so important," she murmured.

"Oh, well," said Falkayn modestly, "I've knocked around a bit, you know. Had the chance to do this and that. Let's talk about you."

She took his pronoun for plural and started off on what must be a prepared lecture.

Antoran did indeed have planets which the Kraoka of Dzua had once colonized. Though the settlers perforce gave up star travel, they had maintained interplanetary commerce down the millennia, keeping more technology than Vanessa did.

Forty-odd years ago, Robert Horn of Nova Germania was being chased by a League cruiser. He laid a course to throw the pursuer off his trail—the old star-dodge maneuver—and thus passed so near Antoran that he detected radio emissions. Later he slipped back to investigate, and discovered the planets.

"Yes, he was an outlaw," his daughter said defiantly. "He was a leader in the Landholders' Revolt . . . so good, so effective, that afterwards they dared not give him amnesty."

Falkayn had heard vaguely about the matter. Something to do with a conspiracy among Nova Germania's first families, descendants of the original pioneers, to get back the power that a new constitution had taken away from them. And, yes, the League was involved; the republican government offered better trading concessions than the Landholders had granted in their day. No wonder this girl was doing the League all the dirt she could.

He smiled and refilled her glass. "I can sympathize," he said. "Being from Hermes, you see. Aristocracy's far and away my favorite system."

Her eyes widened. "You are *adel* . . . nobly born?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Younger son," Falkayn said, modest again. He did not add that he'd been shipped to Earth for his education because he kept kicking over the traces which an aristocrat was expected to carry. "Do go on. You fascinate me."

"The Antoranite System includes one planet which the Kraoka had modified for habitability, but which was too far out, too cold and dark, to be really worth their while. For humans it is better. That is my world, Neuheim."

Hm-m-m, Falkayn thought. This implied at least one planet farther inward which did provide a good Kraokan environment. Very possibly more than one; a war fleet as big as Beljagor claimed he had seen can't be built in a hurry without a lot of population and resources. But this in turn implied a large sun with a wide biothermal zone. Which didn't make sense! Every F-type star in this region had been visited by League surveyors; likewise the G-types; and there definitely was no such system as—

"My father returned in secret to Nova Germania," Jutta Horn said. "He got recruits there and elsewhere. The whole world of Neuheim was given them in exchange for help."

I feel pretty sure they planted the idea of conquest in the first place, Falkayn reflected. *Yeh, I can guess how Kraoka might fall for the concept of a reunified Vaterland. And given enough anti-League propaganda, they might well come to believe that the only way to get unification is to expel us first.*

"So Germanian engineers showed the Antoranites how to make hyperdrive ships," he said, "and Germanian officers trained the crews; and Germanian secret agents kept track of events outsystem—my, you've been busy."

She nodded. Two drinks blurred her tone a little. "That is true. Everything comes second to the crusade. Afterward we can relax. How I look forward!"

"Why not start right away?" Falkayn asked. "Why fight the League? We've no objection to the Kraoka building a star marine at their own expense, nor to any social arrangements you've made on Neuheim."

"After the way the League meddled in the past?" she challenged.

"Yes, granted, we do, now and then, when our interests are threatened. But still, Jutta"—there, he'd established a first-name relationship—"the Polesotechnic League is not a state, not even a government. It's nothing but a mutual-benefit association of interstellar merchants, who're probably more wolfish toward each other than toward anybody outside."

"Power is the one basis of negotiation," she said, turning Clausewitzian. "When we and our allies have secured this region, then perhaps we will allow you to operate here again . . . under our rules. Otherwise you could too easily impose

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

your will on us, if we did not desire the same things as you."

"The League isn't going to take this lying down," he warned.

"I think the League had better do so," she retorted. "We are here, in the region, with interior lines of communication. We can strike from space, anywhere. A League warfleet must come across many parsecs. It will find its bases demolished. And it will not know where our home planets are!"

Falkayn backed off in haste. He didn't want her in that mood. "You certainly have a tremendous advantage," he said. "The League can muster forces greater by orders of magnitude—surely you realize that—but the League may well decide that the cost of defeating you would be greater than any possible gain in doing so."

"Thus my father calculated before he died. Merchants, who lust for nothing but money, can be cowed. *Adelsvolk* are different. They live for an ideal, not for economics."

I wish you'd had a chance to stick that pretty nose out of your smug, ingrown little kingdom and see what working aristocrats are like, Falkayn thought. Aloud: "Well, now, Jutta, I can't quite agree. Remember, I'm both a merchant and a nobleman's son. The psychologists aren't so unlike. A peer has to be a politician, with everything that that entails, or he's no good. And a merchant has to be an idealist."

"What?" She blinked in startlement. "How?"

"Why, you don't think we work for money alone, do you? If that were the object, we'd stay safe and snug at home. No, it's adventure, new horizons, life's conquest of inanimate nature—the universe itself, the grandest enemy of all."

She frowned, but she was softened. "I do not understand, quite."

"Suppose I give you a few examples—"

Dinner was served in the roof turret, which had a view like being outdoors. By night Vanessa took on beauty. Both moons were aloft, small and swift, turning the land to a fantasy of dim silver and moving shadows. The lake gleamed, the native towers looked like giant blossoms. Overhead the sky was splendid with stars, Beta Centauri the king jewel, its blue radiance matching the moons'.

And glowpanels caressed Jutta's sun-browned cheeks with their own light; and Beethoven's Seventh lilted softly from a speaker; and bubbles danced in the champagne glasses. Dinner had made its stately progression from hors d'oeuvres and consommé through fish, roast, and salad, to petits fours and now cheeses. Falkayn had kept the magnum flask busy. Not that either party was drunk—Jutta, alas, had so far kept her wits patriotically about her—but they both felt more than cheerful.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Tell me other things," she urged. "You have had such a wonderful existence, David. Like the hero of an ancient saga—but this is now, which makes it twice as good."

"Let me think," he said, giving her a refill. "Maybe the time I cracked up on a rogue planet?"

"A what?"

"Free planet, sunless. More of them floating around in space than there are stars. The smaller the body, you see, the likelier it was to form when the galaxy coalesced. Normally you find them in groups . . . to be honest, you don't normally find them, because space is big and they are little and dark. But by sheer chance, on the way from Tau Ceti to 70 Ophiuchi, I—"

The adventure had, in fact, happened to somebody else. So had most of the stories Falkayn had been relating. But he saw no reason to spoil a good yarn with pedantry.

Besides, she continued to sip, in an absentminded and unsuspecting way, while he talked.

" . . . And finally I replenished my air by boiling and processing frozen gases. And was I glad to leave!"

"I should think so." She shivered. "Space is bleak. Lovely, but bleak. I like planets better." She gazed outward. "The night here is different from home. I don't know which I like best, Neuheim or Vanessa. After dark, I mean," she added. "None of the Kraokan worlds are pleasant by day."

"None whatsoever? You must have seen quite a variety, with three of them for neighbors."

"Five," she corrected. Her hand went to her mouth. *"Lieber Gott!* I didn't mean to tell."

He chuckled, though inwardly he thrummed with a new excitement. Judas! Five planets—six, counting Neuheim—in the thermal zone where water was liquid . . . around one star! "It doesn't make any practical difference," he said, "when you've evidently found some way to make your whole system invisible. I'd like to know more about you, that's all, and I can't unless you tell me something about your home." He reached across the table and patted her hand. "That's what gave you your dreams, your hopes—your charm, if I may say so. Neuheim must be a paradise."

"No, it is a hard world for humans," she answered earnestly. "In my own lifetime, we have had to move entire villages toward the poles as the planet swung closer to the sun. Even the Kraoka have their troubles for similar reasons." She pulled free of his touch. "But I am talking of what I shouldn't."

"Very well, let's keep to harmless things," he said. "You mentioned that the nights were different at home. In what way?"

"Oh . . . different constellations, of course. Not greatly, but enough to notice. And then, because of the auroras, we never see the stars so clearly as here, from any

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

location. I *must* not say more. You are far too observing, Davy. Tell me, instead, about your Hermes." She smiled irresistibly. "I would like to know where your own dreams come from."

Nothing loath, Falkayn spoke of mountains, virgin wilderness, plains darkened by horned herds, surf-bathing at Thunderstrands—"What does that mean, Davy?"

"Why, bathing in the surf. You know, the waves caused by tidal action." He decided to disarm her suspicions with a joke. "Now, my poor innocent, you've given yourself away again. You imply Neuheim doesn't have tides."

"No harm in that," she said. "True, we have not any moon. The oceans are like huge, still lakes."

"Doesn't the sun—" He checked himself.

"Not so far away as it is, a tiny point of fire, I can't get used to the disk here." Abruptly Jutta set down her glass. "Listen," she said, "you are either very young and sweet or you are clever as Satan."

"Why not both?"

"I cannot take the chance." She rose. "Best I leave now. I made a mistake to come."

"What?" He scrambled to his own feet. "But the evening's hardly begun. I thought we'd go back to the living room and relax with some more music." The *Liebestod*, for instance.

"No." Distress and determination chased each other across her face. "I enjoy myself too much. I forget to guard my tongue. Take to the League this word from us. Before they can marshal against us, we will have the Kraokan stars, and more. But if the League will be reasonable, *jo*, perhaps we can discuss trade treaties." Her eyes dropped. She flushed. "I would like if you could return."

Politics! Falkayn groaned. He got nowhere trying to change her mind, and must finally see her to the door. There he kissed her hand . . . and before he could build on that beginning, she had whispered good night and was outside.

He poured himself a stiff whiskey, lit his pipe, and flung himself into a lounger. None were an adequate substitute.

Rats! he brooded. *Giant mutant rats! She'll have me hustled off the planet right away, tomorrow dawn, before I can use any information I might have gathered.*

Well, at least there'll be girls at Sector HQ. And maybe, eventually, I'll find myself back here.

As a journeyman assistant; and Jutta will be at the social apex of an interstellar empire. She wouldn't snub me on that account, but what chance would we ever have to get together?

He puffed hard and scowled at a repro of a Hokusai portrait, an old man, which hung opposite him. The old man smiled back till Falkayn wanted to punch him in the nose.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The long-range significance of the Neuheimer scheme was far nastier than several gigacredits' loss to the merchant princes, Falkayn saw. Suppose it did succeed. Suppose the mighty Polesotechnic League was defied and defeated, and the Kraokan Empire was established. Well, the Kraoka by themselves might or might not be content to stop at that point and settle down to peaceful relationships with everybody else. In any event, they were no direct threat to the human race; they didn't want the same kind of real estate.

But the Neuheimer humans—Already they spoke of themselves as crusaders. Consider the past history of Homo self-styled sapiens and imagine what so spectacular a success would do to a bunch of ideologically motivated militarists! Oh, the process would be slow: they'd have to increase their numbers, and enlarge their industrial base, and get control of every man-useful planet in this neighborhood. But eventually, for power, and glory, and upset of the hated merchants, and advancement of a Way of Life—war.

The time to squelch them was now. A good healthy licking would discredit the Landholders; peace, mercantilism, and cooperation with others—or, at least, simple cutthroat economic competition—would become fashionable on Neuheim; and, incidentally, a journeyman who played a significant part in that outcome could expect early certification as a Master Merchant.

Whereas a mere bearer of bad tidings—

"All right," Falkayn muttered. "Step One in the squelching process: Find their planetary system!"

They couldn't hope to keep its location secret forever. Just long enough to secure a grip on this region; and given the destructive power of a space fleet, that needn't be very long. While it remained hidden, though, the source of their strength was quite efficiently protected. Hence their entire effort could go into purely offensive operations, which gave them a military capability far out of proportion to their actual force.

Nonetheless, if the League should decide to fight, the League would win. No question about that. In the course of the war, the secret was bound to be discovered, one way or another. And then—nuclear bombardment from space—*No!*

The Landholders were gambling that the League, rather than start an expensive battle for a prize that would certainly be ruined in the course of the fighting, would vote to cut its losses and come to terms. Antoran being hidden, the bet looked fairly good. But no matter how favorable the odds, only fanatics played with entire living worlds for stakes. Poor Jutta! What foul company she was mixed up in. How he'd like to introduce her to some decent people.

O.K., then, where was that star?

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Some place not far off. Jutta had betrayed nothing by admitting that the constellations at home were almost like the constellations here. The ancient Kraoka could not have traveled any enormous ways, as interstellar distances go. Also, the home base must be in this territory so that its fleet could exploit the advantage of interior communications.

And Antoran must be large and bright, no later in the main sequence than, say, GO. Yet . . . every possible sun was already eliminated by information the League had long possessed.

Unless—wait a minute—could it be hidden by a thick nebulosity?

No. There'd still be radio indications. And Jutta had spoken of seeing stars from her home.

Aurora. Hm-m-m. She'd mentioned the necessity for certain villagers to migrate toward the poles, as her planet got too near its primary. Which meant their original settlements were a good bit farther toward the equator. Even so, auroras had been conspicuous: everywhere you went, she'd said. This, again, suggested a highly energetic sun.

Funny, about the eccentric orbit. More than one planet in the system, too, with the same problem. Unheard of. You'd almost think that—

Falkayn sat bolt upright. His pipe dropped from his jaws to his lap. "Holy . . . hyper . . . Judas," he gasped.

Thereafter he thought most furiously. He did not come back to himself until the coals from his pipe set fire to his trousers.

The door to Beljagor's place, offices-cum-residence, barely had time to get out of Falkayn's way. But as he entered the lobby, he skidded to a stop. In a small room opening on this, two Kraoka were talking. One was armed and brassarded, an invader. The other was Quillipup. They froze.

"Greetings," said the liaison agent after a pause. "What brings you here?"

"I want to see your boss," Falkayn answered.

"I believe he is asleep," Quillipup said.

"Too bad." Falkayn started down the hall.

"Stop!" Quillipup bounded after him. "I told you he is asleep."

"And I told you it's a pity he has to be wakened," Falkayn rapped.

Quillipup regarded him. Her dorsal fin rose. The Antoranite glided close behind, hand not far from blaster.

"What have you to say which is so urgent?" Quillipup asked slowly.

Falkayn gave her eyeball for eyeball and responded, "What's so urgent for you, that it can't wait till Beljagor has risen?"

Silence, under the icy white light. Falkayn grew aware of blood pounding in his ears. His skin prickled. That energy gun looked too

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

businesslike for his taste. But Quillipup turned on her heel, without a word, and led her companion back to the office. Falkayn let out a hard-held breath and continued on his way.

He hadn't been told where in the building the factor lived, but the layout of places like this was pretty standardized. The suite door was locked. He buzzed. Nothing happened. He buzzed again.

The scanner must have a screen in the bedroom, because the voice from the annunciator rasped, "You! Do you suppose I'd get up for a pestilential human?"

"Yes," Falkayn said. "Urgent."

"Urgent that you jump off the nearest cliff, right. And a bad night to you." The speaker clicked off.

That adjective "urgent" was being overworked, Falkayn decided. He leaned on the buzzer.

"Stop your infernal racket!" howled Beljagor.

"Sure, when you let me in," Falkayn said.

Click.

Falkayn whistled "The Blue Danube" to pass the time while he leaned on the buzzer.

The door flew open. Beljagor bounced forth. Falkayn was interested to note that the Jaleelan slept in pajamas, bright purple ones. "You insolent whelp!" the factor bawled. "Get out of here!"

"Yes, sir," Falkayn said. "You come, too."

"What?"

"I have to show you something in my spaceboat."

Beljagor's eyes turned red. His tendrils stood erect. He drank air until his small round form seemed ready to explode.

"Please, sir," Falkayn begged. "You've got to. It's terribly important."

Beljagor cursed and swung a fist.

Falkayn sidestepped the blow, picked up the Master Merchant by collar and trousers, and bore him kicking and yelling down the hall. "I told you you had to come," the journeyman said patiently.

The two Kraoka in the lobby had left, and those on sentry-go at the warship made no move to interfere. Maybe, behind furry poker faces, they enjoyed the sight. Falkayn had left the gangway ramp extruded from his speedster but had put a recognition lock on the entrance. It opened for him. He carried Beljagor inside, set him down, and waited for the storm to break.

The Jaleelan spoke no word, only looked at him. His snout quivered a little.

"O.K.," Falkayn sighed. "You don't accept my apologies. You'll have my certificate revoked. You'll strangle me with my own guts. Anything else?"

"I suppose you have an explanation," Beljagor said like fingernails going quite slowly over a blackboard.

"Yes, sir. The business won't

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

wait. And I didn't dare speak any place but here. Your Quillipup is acting far too friendly with the self-appointed liberators. Be no trick for her to bug your quarters."

What ozone had come in with them—less than by day—must have been processed into oxygen by now. Falkayn slipped off his filter mask. Beljagor mumbled something about Earth-type atmosphere, otherwise, the factor had cooled off astonishingly fast. "Talk, cub," he ordered.

"You see," Falkayn said, "I know where Antoran is."

"Heh?" Beljagor jumped several centimeters in the pilot chair he occupied.

"They'd never let me go if they found out I know," Falkayn continued. He leaned back against a bulkhead. His gaze drifted beyond the viewports. Both moons had set, and Beta Centauri ruled heaven. "As is, you'll have to come, too."

"What? Impossible! If you think I'll abandon the property of General Motors to a gang of pirates—"

"They'll doubtless send you packing before long in any event," Falkayn said. "Admit that. You just hate to surrender. But we've got to take the bull by the tail and look the situation squarely in the face."

"What do you mean, you know where Antoran is?" Beljagor spluttered. "Did you swallow something the Horn creature told you for a joke?"

"No, sir, she didn't intend to give me any information. Only, well, she was raised in an isolated, dedicated, Spartan society. She wasn't equipped to handle me." Falkayn grinned. "Figuratively, I mean, not literally. Her fellows didn't allow for the effects of alcohol and smooth talk. Not used to such things themselves, I imagine. Could be they also counted on my being so overbowled by her looks that I'd merely gawk and listen to her. They seem to be a very romantic bunch. Dangerous as hell, but romantic."

"Well? Well? What did Horn say?"

"Little items. They gave the show away, though. Like, Antoran isn't a planet but a star. And just one star hereabouts can possibly fit the data." Falkayn let Beljagor rumble for a moment before he pointed skyward and said, "Beta Centauri."

The factor did explode. He hopped around the cabin, flapping his arms and raving. Falkayn filed the choicer epithets in his memory for later use.

At last Beljagor was sufficiently calm to stand in one spot, raise a finger, and say, "You unutterable imbecile, for your information, Beta is a type B blue giant. People knew, before space flight began, giant suns don't have planets. Angular momentum per unit mass proved as much. After the hyperdrive came along, direct expeditions to any number of them clinched the matter. Even supposing, somehow, one did acquire satellites, those satellites never would get habitable. Giant

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

stars burn hydrogen so fast their existence is measured in millions of years. Millions, you hear, not billions. Beta Centauri can hardly be ten million years old. More than half its stable lifetime is past. It'll go supernova and become a white dwarf. Life'd have no chance to evolve before the planets were destroyed. Not that there are any, I repeat. The reason for only the smaller suns having planets is understood. A big protostar, condensing from the interstellar medium, develops too intense a gravitational field for the secondary condensation process to take place outside it.

"I thought even humans learned so much elementary astrophysics in the first grade of school. I was wrong. Now you know."

His voice rose to a scream. *"And for this you got me out of bed!"*

Falkayn moved to block the cabin exit. "But I do know," he said. "Everybody does. The Antoranites have based their whole strategy on our preconception. They figure by the time we discover Beta Centauri is a freak case, they'll control the whole region."

Beljagor hurled himself back into the pilot chair, folded his arms, and grated, "Well, get the farce over with, since you must."

"Here are the facts," Falkayn said. He ticked them off. "One, the Antoranite System was colonized by Kraoka, who couldn't and didn't settle on planets with suns as cool as Sol. Two, Antoran has six planets in the liquid-water zone. No matter how you arrange their orbits, that zone has to be mighty broad—which indicates a correspondingly luminous star. Three, the outermost of those six planets is too cold and weakly irradiated for Kraokan comfort, but suits humans fairly well. Yet it has brilliant auroras even in the temperate zones. For that, you need a sun which shoots out some terrifically energetic particles: again, a giant.

"Four, this human planet, Neuheim, is far out. The proof lies in three separate facts. (a) From Neuheim, the sun doesn't have a naked-eye disk. (b) There are no solar tides worth mentioning. (c) The year is long, I figure something like two Earth centuries. I know the year is long, because Jutta let slip that her people had to shift some towns poleward a while back. Orbital eccentricity was making the lower latitudes too hot, maybe also too much UV was penetrating the ozone layer in those parts and making poisonous concentrations of ozone at the surface, like here. Nevertheless, the original human settlement was forty years ago. In other words, Neuheim's radius vector changes at so leisurely a rate that it was worth sitting down in areas which the colonists knew would have to be abandoned later. I suppose they wanted to exploit local minerals.

"O.K. In spite of its enormous distance from the primary, Neu-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

heim *is* habitable, if you don't mind getting a deep suntan. What kind of star can buck the inverse-square law on so grand a scale? What but a blue giant! And Beta Centauri is the only blue giant close by."

He stopped, hoarse and in need of beer. Beljagor sat like a graven image, assuming that anybody would want to grave such an image, while the minutes stretched. A spaceboat whined overhead, an enemy craft on an unknown errand.

Finally, tonelessly, Beljagor asked, "How could there be planets?"

"I've worked that out," Falkayn replied. "A freak, as I remarked before, perhaps the only case in the universe, but still possible. The star captured a mess of rogue planets."

"Nonsense. Single bodies can't make captures." But Beljagor didn't yell his objection.

"Granted. Here's what must have happened. Beta was condensing, with a massive nucleus already but maybe half its mass still spread over God knows how many astronomical units, as a nebular cloud. A cluster of rogue planets passed through. Beta's gravity field swung them around. But because of friction with the nebula, they didn't recede into space again. Energy loss, you see, converting hyperbolic orbits into elliptical ones. Could be that there was also a secondary center of stellar condensation, which later spiraled into the main mass. Two bodies can certainly make captures. But I think friction alone would serve.

"The elliptical orbits were almighty eccentric, of course. Friction smoothed them out some. But Jutta admitted that to this day the planets have paths eccentric enough to cause weather trouble. Which is not the normal case either, you recall. Makes another clue for us."

"Hm-m-m." Beljagor tugged his nose and pondered.

"The planets would've exuded gases and water vapor in the early stages of their existence, through vulcanism, like any other substellar globes," Falkayn plowed on. "The stuff froze in space. But Beta unfroze it.

"I don't know how the Kraoka of Dzua learned what the situation was. Maybe they simply didn't know that blue giants don't have planets. Or maybe they sent a telemetric probe for astrophysical research, and it informed them. Anyhow, they discovered Beta had five potentially good worlds plus one that was marginal for them. So they colonized. Sure, the planets were sterile, with poisonous atmospheres. But the ancient Kraoka were whizzes at environmental engineering. You can sketch for yourself what they did: seeded the air with photosynthetic forms of life to consume the primeval organic matter and form the basis of an ecology, et cetera. Under those conditions, microbes would multiply exponentially, and it'd take no more than a few centuries for a world to become habitable."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Falkayn shrugged. "Beta will blow up and destroy their work in five or ten million years," he finished. "But that's ample time for anyone, hey?"

"Yes," Beljagor said low.

He raised his head, looked directly at the man, and said, "If this be true, we've got to tell the League. A war fleet that went straight to Beta should catch the enemy by complete surprise. Once the home planets were hostage to us, obviously there'd be no fighting."

"Uh-huh." Falkayn suppressed a yawn. Weariness was beginning to overtake him.

"But this is only a hypothesis," Beljagor said. "Your evidence is all hearsay. Horn could've been putting you on. The League can't base a whole operation on an idea which may turn out wrong. That'd be ruinous. We need positive proof."

"Right," Falkayn nodded. "So we'll both go, in our separate boats. You can easily make some excuse for having changed your mind about staying here. They won't suspect a thing if you throw a temper tantrum and storm off into space."

Beljagor grew rigid. "What are you saying? I'm the most patient, considerate entity in this cosmos."

"Huh?"

"When I think of what I have to put up with, impertinence like yours, stupidity, greed, thievishness, lack of appreciation—" Beljagor's tone mounted to a dull roar. Falkayn smothered a second yawn.

"Well, no matter now," said the factor as a coda. "I'll think of something. What do you propose after we take off?"

"We'll start ostensibly for HQ," Falkayn said. "Once we're out of detector range, we'll head toward Beta. We'll stop at a safe distance. You wait. I'll run in close to the star and make observations. Then I'll come back to you and we really will skite for home and mother."

"Why the separate excursion?"

"I might get caught. In that case —if I haven't rejoined you by the agreed time—you can tell the League what we do know and suggest they investigate Beta themselves."

"Hm-m-m. Ha. Correct. But why do you volunteer for the dangerous part? I doubt that you're competent."

"Sir," Falkayn said tiredly, "I may be young, but I can handle instruments. This speedster is built for humans—you couldn't operate her efficiently—and she's better adapted to a quick job of spying than your craft. So I'm elected. Besides," he added, "if I get clobbered, I'm a mere journeyman, a human at that. You're a Master Merchant from Jaleel."

His sarcasm went to waste. Beljagor sprang erect with tears starting from his porcine eyes. "Right!" he cried, choked by emotion. "How noble of you to admit it!" He wrung Falkayn's hand. "Please don't think badly of me. I may be loud now

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

and then—I may talk rough when my patience wears thin—but believe me, I've got no prejudice against your race. Humans have fine qualities. Why, some of my best friends are human!"

Danger began about one light-year from goal: the distance within which the instantaneous space-time pulses emitted by a vessel in hyperdrive are detectable. Beljagor's boat lay outside that radius, her own detectors wide open. Not that there was any measurable chance of a speck like her being found by accident. Falkayn would have trouble enough making rendezvous, knowing her location. But, if Beljagor observed the "wake" of another ship, he would be careful not to start his own secondary engines until the stranger was safely remote again.

Falkayn had no like choice. At full quasi-speed, he drove straight for Beta Centauri.

The sun grew and grew before him. Under magnification, he could see the disk, seething with nuclear storms, raging with billion-kilometer prominences, hell-blue and terrible. Eleven times the mass of Sol; fourteen hundred times the luminosity; across a full hundred and ninety light-years, one of the brightest stars in Earth's sky. He tried to whistle a tune, but the sound was too small and scared.

Inward. Inward. Now he could start the cameras. Photographing the viewscreens, which compensated for aberration and Doppler effect, they pictured a stable background of constellations. Planets, though, registered as meteorite streaks—yes, here! Falkayn changed course and repeated his observations. Before long he had the triangulation data to feed his computer.

He'd only spotted a few of the captured worlds, not all of them possible habitations. What he had was sufficient, however, especially when one turned out to be approximately thirty-seven astronomical units from the sun, the right distance and the right diameter for Neuheim. And, uh-huh, his detectors showed hyper-vibrations crisscrossing local space, comings and goings among the stars.

One indication was too near for his liking, and getting nearer. A patrol craft must have sniffed his trail and be on her way to investigate. Well, she'd have to be fiendishly fast to catch this little beauty of his!

She was.

As he fled spaceward, Falkayn watched the intensity readings creep higher. He scowled, puffed his pipe, and figured. He could rendezvous with Beljagor before he was overhauled, but then the Antoranite would be within a light-year of them, and get a fix on both.

Well, they could separate. . .

A second needle flickered on the detector panel. Falkayn said bad words. Another ship was closing in.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Extrapolating directions and rates of amplitude increase, he found that Number Two couldn't run him down—but could snag Beljagor's ambling Holbert.

So. The thing to do was switch off the secondaries and lie doggo, hidden by the sheer vastness of space . . . Uh-uh. If those fellows knew their business, they'd identify the point where he stopped—at this range—within several million kilometers. They'd also go sublight, and home on the neutrino emission of his power plant. Or simply finger him with a radar sweep.

"Brother," Falkayn told himself, "you've had it, with pineapples."

He looked into the glory which was space, sun after sun until suns grew so thick that they melted into the great argent flood of the Milky Way. He remembered how light is trapped in the leaves of a wind-tossed tree; and how good the beer had tasted in a funny little Swiss tavern; and how often he had laughed among friends; and he sensed an utter lack of ambition to be a hero.

Don't irritate them. Surrender. Otherwise they'll phase in to your hyperjump frequency and put a warhead between your ears.

Beljagor could still report to the League, after the enemy had returned home. Of course, then he'd have no confirmation of Beta Centauri's nature. Falkayn's not showing up was inadequate proof, when he could have come to grief in any number of ways. So the League must send spies of its own, who would also be detected. Using ultrafast ships, they'd get away, but the enemy would be alerted and would mount strong guard on his home country. If war then came, it would be more savage than one dared think about, whole planets might be incinerated, Jutta be blown to incandescent gas, Falkayn himself . . . Judas!

Why wasn't there faster-than-light radio, so he could beam a message to the factor before he must stop? Damn the laws of physics!

The boat hummed and quivered with driving energies. Falkayn was maddeningly aware of thirst, an itch between his shoulderblades, a need for a haircut. This was no time to be human. *Think, blast you.*

He couldn't. He prowled the cabin, smoked his tongue leathery, forced down a plateful of rations, and came back to gloom at the detectors. Until finally he said, "To hell with this," killed his last bottle of booze and went to sleep.

He awoke some hours later, and there was his solution. For a while he lay staring at the overhead, awed by his genius. But according to computation, he'd soon reach Beljagor. Which meant he was in detection range right now, and the Jaleelan was certainly cursing a Beta-colored streak as he watched his own instruments. He'd not be asleep under these circumstances—not him.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"No time like the present," Falkayn said, thus proving his originality had limits. He sprang from his bunk and started scribbling notes.

"O.K., chum." He settled into the pilot chair.

Switch off the secondaries and go sublight. One minute later, switch them back on. Thirty seconds later, off again. One minute later, on again.

Polesotechnic pulse code. The needles of whichever detectors were tuned on him must be jumping back and forth, dash-dot-dash-dash-dot. HYPOTHESIS CONFIRMED. F. Repeat the cycle, to be sure Beljagor noticed. And again. Let him wonder if the F was anything but an initial. He'd get the rest of the idea, which was all that mattered. God willing, the Antoranites would not; this particular code was kept secret.

The engines began objecting to abuse. Falkayn whiffed scorched insulation and heard an ominous whine in the power hum. He switched vectors, taking off at a sharp angle to his former path, and drove steadily.

Arithmetic showed that when Enemy Number One pulled alongside him, they'd be well over a light-year from Beljagor. So would Enemy Number Two, who was obligingly coming about also. Falkayn left the board on automatic, showered, dressed in his fanciest clothes, and fixed a leisurely breakfast.

Next he destroyed his photographs, registry, route papers, and certain parts of his log, and did an artistic job of forging substitutes. League vessels are equipped for a variety of emergencies.

The Antoranite hove close, a Comet class with wicked-looking guns. Her probelight flashed the command to halt. Falkayn obeyed. The other went sublight likewise, matched kinetic velocities, and lay at a cautious distance. The radio buzzed. Falkayn accepted.

A long-jawed human officer type with a chestful of ribbons glared from the screen. "Hello," Falkayn said. "Do you speak Anglic or Latin?"

"Ja," said the man. He picked the former. "Yourself identify."

"PL speedster *Greased Lightning* out of Tricorn for Hopewell, journeyman, Sebastian Tombs aboard solo. And who might you be?"

"Neuheim warship *Graf Helmuth Karl Bernhard von Moltke,* Landholder Otto von Lichtenberg commanding, *Oberleutnant* Walter Schmitt speaking."

"Neuheim? Where the devil is Neuheim? Never heard of it."

"Vot iss your purpose? Vy haff you tried to escape?"

"My purpose," Falkayn said, "is a trip from my post on Tricorn to ask for some emergency supplies from the Polesotechnic station on Hopewell. We had a flood and it rather messed us up. As for why I ran from you, when strangers start

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

chasing a fellow, what do you expect him to do?"

"You assumed ve vas unfriendly," Schmitt said, more in anger than in sorrow. "Maybe you iss unfriendly to us, ha?"

"No, ha. If you consult your navigation tables, you'll find Beta Centauri is almost directly between Tricorn and Hopewell. And I was bound for Hopewell, instead of some closer post, because Hopewell is the nearest planet where I can be sure of getting the stuff we need. Zipping past Beta, I noticed a roughness in the engines." It was there yet, thanks to his using them for a radio. "To check the vector control, I changed course a few times, as you probably noticed. Then all at once, *whoosh*, here I detected a ship headed for me where no ship ought to be. Perhaps you were a harmless scientific expedition, anxious for a gabfest. But I wasn't about to chance it. Pirates do exist, you know. I skedaddled. My engines began spontaneously popping in and out of secondary. I got the Lauritzens fixed and tried a change of course, hoping you'd understand I didn't want company and leave me alone. No luck. So here we are."

Falkayn donned an indignant look and pounded the pilot board. "Seems like you're the one who has explaining to do," he barked. "What is this Neuheim comedy? Why are warships hanging around a blue giant? What's the idea, taking off after a harmless passerby? The Polesotechnic League is going to hear about this!"

"Perhaps," said Schmitt. "Shtand by to be boarded."

"Damnation, you certainly have no right—"

"Ve haff several nuclear cannon zeroed on you. Giffs t'at a right?"

"It does," Falkayn sighed.

He cooperated in linking air locks by a gangtube. Schmitt entered with a squad, who pointed their rifles at him, and demanded to see his papers.

Presently: "Fery vell, Herr Tombs. Might be you are honest. I do not know. Ve haff our orders. It vill be necessary to intern you on Neuheim."

"What?" Falkayn bellowed. He held his breath till he turned scarlet and his eyes popped. "Do you realize who I am? I'm a certified member of the Polesotechnic League!"

"Too bad for you," Schmitt said. "Come along." He grabbed Falkayn's wrist.

Falkayn yanked it back, drew himself straight, and blessed his father for teaching him the proper mannerisms. "Sir," he said, and liquid helium dripped from every word, "if I am to be a prisoner, I protest the illegality but I must yield. Nevertheless, there is such a thing as the laws of war. Furthermore, I am heir apparent to the Barony of Dragonshaw, United Kingdom of New Asia and Radagach. You will treat

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

me with the respect according to my station!"

Schmitt paled. He clicked his heels, bowed, and followed with a salute. *"Jawohl, mein Herr,"* he gasped. "I beg for your most gracious pardon. If you had seen fit to tell me more earlier—Landholder von Lichtenberg vill be reqvesting t'e honor uff your pressence at tea."

Schloss Graustein was not the worst place in the cosmos to be a prisoner. Though gaunt and drafty on its high ridge, it was surrounded by forests where the hunting was excellent. The food was heavy but edible, and the local beer superb. Landholder Graustein did his best to make the distinguished, if compulsory, guest feel at home. During long conversations and occasional guided tours of the planet, Falkayn spotted interesting commercial opportunities, once the region had been pacified.

Unless— He didn't want to contemplate the alternative. And after some weeks, time began to hang as leaden as the *knackwurst*.

Thus Falkayn was quite happy when a servant knocked at the door of his suite and announced a visitor. But then she stepped through. He had never thought she would be an unwelcome sight.

"Jutta," he whispered.

She closed the door behind her. Dark wood and granite panels framed her where she stood vivid under the fluorolight. She was in mufti, and if he had thought her beautiful when uniformed, he must now multiply by an astronomical factor.

"So it is indeed you," she said.

"P-p-please sit down," he managed.

She remained standing. Her features were stony, her voice flat. "Those idiots took for granted you were what you claimed, a merchant who simply chanced to pass by and saw too much. They never interrogated you in depth, never notified the fleet command. I only heard of you yesterday, in conversation with Landholder von Lichtenberg, after I came home on leave. The description—" Words trailed off.

Falkayn rallied his courage. "A stratagem of war, my dear," he said gently.

"What have you done?"

He told his pulse to decelerate, took out his pipe, and made a production of loading and kindling it. "You can squirt me full of babble juice, so I might as well Tell All," he smiled. "I guessed the truth and went for a look to make certain."

"That funny little being who left about the same time as you did . . . he knew?"

Falkayn nodded. "He's reported to HQ long ago. If the League is half as realistic as I think, a battle fleet you can't hope to resist is on its way right now."

She clenched one hand over another. Tears stood in her eyes. "What follows?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"They should head straight here. I expect them any day. You've nothing in the Beta System except a few patrollers; the rest of your navy is spread over a dozen stars. Right?" The League doesn't want to bombard planets, but in the case—" She uttered anguish. He went quickly to her, took both those hands, and said, "No, no. *Realpolitik,* remember? The object of war is not to destroy the enemy but to impose your will on him. Why should we kill people that we might sell things to? We'll simply take the Beta System prisoner, and then bargain about its release.

"I don't make policy, but I can predict what'll happen. The League will demand you disband your armed forces, down to a normal defense level. And, naturally, we'll want to keep our trade concessions. But that's all. Now that some Kraoka have starships, they can go ahead and unify, as long as they do it peacefully. We'd hoped to sell them a cargo and passenger fleet, at a huge markup, but that hope isn't worth fighting for—you do have bargaining power yourselves, in your own capabilities for making trouble, you know. Neuheim can keep any social order it wants. Why not? If you try to maintain this wretched autarchy, you'll be depriving yourselves of so much that inside of ten years your people will throw out the Landholders and yell for us."

He chucked her under the chin. "I understand," he said. "It's tough when a dream dies. But why should you, your whole life, carry your father's grudges?"

She surrendered to tears. He consoled her, and a private hope began to grow in him.

Not that he was in the market for a wife. Judas! At his age? However—

Afterward they found themselves on the balcony. Night had fallen, the auroral night where vast banners shook red and green across the sky, dimming the stars, and the mountain swooped down to a forest which breathed strange sweet odors back upward. Wine glasses were in their hands, and she stood close to him.

"You can report who I am," he said, "and cause me to have an unpleasant time, maybe even be shot." Pale in the shuddering light, her face lost its look of happiness and he heard the breath suck between her teeth. "Your duty, according to the articles of war," he continued. "And it won't make one bit of difference, it'll be too late—except that the League protects its own and will take a stiff price for me."

"What choice have I?" she pleaded.

He flashed a well-rehearsed grin. "Why, to keep your lovely mouth shut, tell everybody you were mistaken and Sebastian Tombs has nothing to do with that Falkayn character. When peace comes—

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

well, you're quite influential on this planet. You could do a lot to help your people adjust."

"And become merchants?" she said, in a dying flare of scorn.

"I remarked once," he said, "that we aren't really so ignoble. We're after a profit, yes. But even a knight must eat, and *our* bread doesn't come from slaves or serfs or anyone who had to be killed. Look beyond those lights. They're fine, sure, but how about the stars on the other side?"

She caught his arm. He murmured, as best he could in Latin, *"Thy merchants chase the morning down the sea . . ."* and when she turned questioning to him he added, low in the dusk,

"Their topmasts gilt by sunset, though their sails be whipped to rags,
Who raced the wind around the world go reeling home again,
With ivory, apes, and peacocks loaded, memories and brags,
To sell for this high profit: knowing fully they are Men!"

"Oh-h-h," he heard.

And to think he'd resented his schoolmasters, when he was a kid on Hermes, making him read Flecker and Sanders in the original.

"I will not tell anyone," she said.

And: "May I stay here for a while?"

Falkayn was downright regretful a week later, when the League fleet arrived to rescue him. ■

THE ANALYTICAL LABORATORY

JANUARY 1966

PLACE	STORY	AUTHOR	POINTS
1.	Beehive (Conclusion)	Mack Reynolds	1.90
2.	Second Seeded	R. C. FitzPatrick	2.18
3.	Untropy	Christopher Anvil	2.83
4.	Kelvin Throop Rudes Again	E. Silverman	2.96

THE EDITOR

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THE REFERENCE LIBRARY

P. Schuyler Miller

WEB

Some twenty years ago the late Bernard Frank, one of the country's foremost forest ecologists, complained to a group of conservationists that there was no American university where he could send his son to learn the facts and principles that he had had to teach himself. Just a few years ago, when Rachel Carson's "Silent Spring" was published, the chemical industry responded with the anguished cry: "Ecology isn't a science! It isn't even in the dictionary." (It was in *Webster's Collegiate,* but they were probably using an obsolete chemical dictionary.)

Actually, apart from the purely physical sciences concerned with releasing and controlling energy, ecology may well be *the* most important science of this or any other era. Its purpose is to develop an understanding of what Joseph Wood Krutch called "the great web of life"—the *gestalt* made up of all the living things in a given "universe," in their relations to it and its special properties, and to each other. When we ignore its principles, as we have and are, through ignorance or obstinacy, we are very likely to use the resources of our locality, or continent, or planet at far less than their capacity. We are also likely to destroy their capacity to support us at all.

It is this science and its fundamental concepts that Frank Herbert made the basis of his two novels here in Analog, "Dune" and "The Prophet of Dune." They are now combined, revised and expanded in one 440-page book, "Dune" (Chilton Books, Philadelphia and New York; 1965; $5.95), which does not credit the magazine source but does reproduce John Schoenherr's wonderful cover for the first part of "Prophet of Dune"—one of the finest SF illustrations of all time.

I argued with Dr. E. E. Smith because he amplified the book ver-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

sions of his "Lensman" series with background information that—for me—destroyed the building suspense of the serials in Astounding. Frank Herbert has done the same thing in his book, supplementing the story with a multi-page glossary of terminology used in the galactic Imperium in which the story is set, and with a map and set of appendixes on the ecology of Dune, the religion of the Fremen, and the history and purpose of the Bene Gesserit. The story doesn't need them, but they help understand its finer points.

"Dune" isn't as good a story as the author's "Dragon in the Sea," but it's a far more amazing accomplishment. Its parallels are with Wright's equally massive "Islandia" and Hal Clement's "Mission of Gravity," but it must have been a more demanding job than either. Wright concerned himself with the intricate social relations of an island continent whose ecology was essentially that of Europe or the eastern United States: he created a people but not a world. Clement's concern was primarily with the kind of life that could exist on his high-gravity, high-rotation world, but only with its highlights. The view of the ecological web of Mesklin is an outsider's rather superficial view.

To do Clement justice, however, it should be said that Mesklin must have had many complex and complexly interacting ecologies, whereas Frank Herbert has simplified his task by making Arrakis a one-ecology world. We see it from inside and outside, in its phenomenal balance and in its interaction with the galactic institutions that are impinging on it and trying to alter it —the Bene Gesserit aeon-spanning plan to breed a superwoman who can comprehend all space and time at once; the Spacing Guild with its jealously guarded monopoly of space transport; the Mentats, mental supermen created by another process than the heirs of the Bene Gesserit; and the feudal society of the Great Houses and the Imperium. As water is the key to the ecology of the desert world of Arrakis, so the "spice" that prolongs life, *melange*, is the Arrakeen key to the ecology of the Imperium.

"Dune" is certainly one of the landmarks of modern science fiction. It is an amazing feat of creation. But, especially in the earlier half before young Paul Atreides becomes the desert mouse of the Fremen, Muad'Dib and the Kwisatz Haderach of the Bene Gesserit, it may move too slowly and require too much thought to earn it a "Hugo" in September.

EXPLORERS INTO INFINITY
By Ray Cummings • Avalon Books, New York • 1965 • 192 pp. • $3.25

Editor Robert A. W. Lowndes' introductions add to the interest of these excavations from the early years of science fiction and fantasy.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

In this case, although the publisher evidently does not agree, it would have been worthwhile stating the source of the book in two stories published in *Weird Tales* in 1927 and '28: the title story and "The Giant World." The jacket speaks of them as novelettes; Brad Day's *Index on the Weird and Fantastica in Magazines* makes them three-part serials; and I don't have a file of that vintage to make checking possible.

These may have been Cummings' first stories for *Weird*. He was turning his "people in the atom" theme inside out: if—as in the earlier stories—an electron could be a planet, why should not our planet be an atomic particle of a higher-order universe? This time, too—though he falls back on his size-changing drugs in the second part of the story—he "invented" a mechanism that would carry his adventurers through space, time and size.

In this amplification of his "scientific" rationale, Cummings clarifies the very peculiar nature of the atomic theory he was using. In discussing "The Girl in the Golden Atom" and its sequels, most commentators make the planetary electron equation, based on Bohr's then new theories, that I used above. This story makes clear that Cummings' atoms—macro as micro—were hollow shells of matter, enclosing a nucleus made up of star-and-planet particles. The world in the golden atom of his first stories was evidently on the outside of such a shell; the giant world of these yarns is on the *inside* of another "atom" in the macro-universe.

The plot line is very simple: an invention enables an old scientist and his sons to see a beautiful girl in peril in the macro-world. One son goes to save her and fails to return. In the sequel, the others go to look for him and find themselves involved in a struggle against evil enemies—this time size-changing giants from the outside of the macro-shell. I don't know how much the originals have been cut for this version, but Cummings' fertile twists of imagination are plentiful and keep the action moving. His peculiar style, which I like but others find abominable, is shown by "Doc" Lowndes to be a transposition of the Spanish syntax of Cummings' Puerto Rican boyhood.

Dated, and far from the best Cummings, but interesting to SF antiquarians. And I'd very much like to know whether such a shell theory of atomic or nuclear structure was respectable in Cummings' time.

SPECTRUM 4

Edited by Kingsley Amis and Robert Conquest • Harcourt, Brace & World, New York • 1965 • 320 pp. • $4.50

This is the fourth in the series of science-fiction anthologies which the editors are putting together for English readers unfamiliar with SF.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

They consequently contain a good many stories that are familiar to American readers from previous anthologies. They're still good stories, and each collection seems to be better than the one before.

One of the gems of this volume is the taped conversation about science fiction, between Amis, Brian Aldiss and the late C. S. Lewis, recorded shortly before the latter's death. There is plenty of food for thought in their discussion of science fiction versus books with SF themes, written by "mainstream" authors.

On the familiar side, we have C. M. Kornbluth's cruel satire of cumulative idiocy, "The Marching Morons," Howard Fast's smoothly professional treatment of a tired theme in "The Large Ant," Anthony Boucher's time-travel classic, "Barrier," Cordwainer Smith's horrible "A Planet Named Shayol," and Damon Knight's classic of extraterrestrial communication, "Stranger Station." "Barrier" first appeared here, as did Christopher Anvil's comedy of unleashed individualism, "Gadget vs. Trend."

"Such Stuff," by John Brunner, is a haunting short story of psychological experiment, utterly unlike that protean author's adventure stuff. One of the serious shortcomings of these British anthologies is the way they short-sell British authors like Brunner.

In "The Sellers of the Dream," John Jakes has picked up the banner of Pohl and Kornbluth to depict the future built on forced obsolescence. Allan Danzig's "The Great Nebraska Sea" is a pseudo-documentary of the cataclysm that ends the central United States—a real rarity these days. John Wyndham's "Compassion Circuit" is another twist on the robots that are just too good to be safe, and Ron Goulart's "Into the Shop" gives the same theme a peculiarly American twist with the lawagon that is the law.

Fritz Leiber, in "The Secret Songs," beautifully depicts the drugged unreality of the world we are building: you can't like it, any more than you can "Coming Attraction," but you can't forget it either. Hal Clement's "Hot Planet" —Mercury—is evidently going to be his most popular recent story; I think this is the third recent reprinting. Finally, "The Choice," by Wayland Young, is another English morsel from *Punch,* just one page long, and devastating.

THE VINTAGE BRADBURY

Vintage Books, New York • 1965 • No. V-294 • 329 pp. • $1.45

On at least two occasions *Time* and *Life* have formally designated Ray Bradbury the "world's greatest" science-fiction writer. Recently, various publishers have been reworking his older short-story collections, dealing new hands out of the pack and using new titles to give the impression that they are

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

offering new stories. This "class" paperback, one of Random House's excellent Vintage Books series, is consequently novel on two counts.

It doesn't pretend to be new, but it *is* Bradbury's choice of twenty-six of his own best stories of all types.

In an excellent introduction, Gilbert Highet says pointblank: "Ray Bradbury is not a science-fiction writer. He is an author of tales of fantasy." And justifies his verdict . . . as many a fan in many a fanzine has done before him.

It's probably the best sample of the kind of writing for which Bradbury wants to be known: some of his kind of science fiction—"There Will Comes Soft Rains," "The Veldt," "Ylla," "The Fog Horn"—some out-and-out fantasy, some "straight" fiction. I would have enjoyed a few more samples of his early *Weird Tales* stories and fewer of the over-stylized excerpts from his imitation of "Penrod" in "Dandelion Days."

SLEEPING PLANET

By William R. Burkett, Jr. • Doubleday & Co., Garden City, N.Y. • 1965 • 297 pp. • $4.95

You read this story as a serial here in Analog about a year ago. Perhaps you remember the cover of sleeping troops. If you weren't a reader then, I must report now that it is by no means the best serial Analog has had recently, although in parts it really swings you along.

Galactic enemies, the Llralans or "Larries," make an end-run around Earth's battle fleet and shower Earth, Mars and Venus with spores of an extraterrestrial plant which duly put mankind, and a good few higher animals, to sleep. They move in on the sleeping planets and hold their billions hostage: if the Terrestrial fleet does not surrender unconditionally, the sleepers will be slaughtered, a city at a time.

But ten people on Earth—a cripple in London, an Atlanta lawyer, and others who barely enter the story—are immune to the sleep dust. They have a simple chore: to defeat the invaders. And they do it.

When Brad Donovan is conning the superstitious Larry troops with yarns about the vengeful ghost of his Grampa, when James Rierson is carrying on his one-man guerrilla war as "Gremper's" ghost, and when the final move against the Larries gets under way, the story moves fast and gloriously. Between times it sags. And I'm afraid the Larries are a bit too human to be taken in as they are.

Mr. Burkett's next for Analog will doubtless be better.

THE CASE FOR GOING TO THE MOON

By Neil P. Ruzic • G. P. Putnam's Sons, New York • 1965 • 240 pp. • $4.95

Neil P. Ruzic is the founder, editor and publisher of *Industrial Re-*

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

search, a magazine which since 1958 has done a notable job of demonstrating the scientific roots of technological advances and the technological implications of scientific discovery. It dedicates itself to prodding, if not needling, the sluggish imaginations of scientists, engineers and research administrators. The articles collected in this book appeared over a period of several months in late 1964 and early 1965. Unfortunately, the book lacks the imaginative layout and illustrations which added to the persuasiveness of the articles; there are some, but not enough.

The author may have disqualified himself from serious consideration by the scientific establishment. He has Arthur C. Clarke on his advisory board, he respects the opinions of writers like Isaac Asimov, and he once wrote a SF short story published in *Galaxy*. Nevertheless, this is not just another blue-sky (or black-space) paean for Moon-going.

Mr. Ruzic prefaced his series of articles by polling the scientific community for its opinions on the case for going to the Moon. He is unreasonably downcast because he considers the returns too low: from 21.4% from chemists and 18.2% from engineers down to 8.3% from geologists and 6% from biologists (who have consistently lobbied against the Moon program, on the argument that they'd rather have the money spent on them). They are low because, he says, his magazine usually averages a 30% return on its questionnaires. This is a tribute to the regard the readers hold for the magazine, not to their usual habits, as advertisers will testify.

A follow-up telephone call to one hundred scientists and engineers who hadn't answered was revealing. More than 65% just didn't care.

You must read the book yourself to appreciate and evaluate the force of Mr. Ruzic's arguments for going to the Moon. He offers them under several pretty broad heads:

The ready-made vacuum and temperature extremes on the surface of the Moon provide a unique opportunity for vacuum research into such things as properties of materials, thin film technology, superconductivity and microminiaturization.

With the basic research in progress, opportunities open for manufacturing that utilize the vacuum and cryogenic conditions, and take their raw materials from the Moon itself. The author has applied for patents for a "lunar cryostat" that makes practical use of the lunar environment for a variety of manufacturing applications. This stage, Mr. Ruzic suggests, should be under way by 1980; the initial research by 1972.

One novel element of Mr. Ruzic's approach is that he sees the immediately practical applications of a

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

base on the Moon as being realized first. "Fundamental" research comes later, once the base is paying its way. Again, he is specific and imaginative. His suggestions provide backgrounds for scores of "hard" science-fiction stories of the kind Arthur Clarke does best.

The "spin off" from the space problem is already evident and acknowledged—although Mr. Ruzic dislikes the term. He feels that in spite of the major advantages already realized by industry, technologists have been far too cautious about utilizing what is already available. "I believe the problem is not that entrepreneurs are not engineers, but that they are not entrepreneurs!" the author says. "They are simply managers, controllers, keepers of the status quo." And that comment launches some pages of vital comments on the habits of American scientists and industrialists.

The manned astronomical observatory on the far side of the Moon, shielded from the glare and radio noise from Earth, might be started by 1980, Mr. Ruzic suggests. His arguments here will be more familiar to readers of Analog.

And finally, utilizing the special advantages of the lunar environment and the research stations set up there, we should be able to contact intelligent extraterrestrial life some time early in the Twenty-first Century, if it is there, and if it is close by.

The subject of "The Case for Going to the Moon" will be familiar enough to readers of Analog, but the point of view from which the case is developed will be novel to anyone who hasn't seen the original articles in *Industrial Research*. And the premise that our first concern should be for practical applications of the lunar environment is basic.

REPRINT SHELF

THE WORLDS OF SCIENCE FICTION

Edited by Robert P. Mills • Paperback Library, New York • No. 54-819 • 1965 • 287 pp. • 75¢

A fat and excellent anthology with all the best names. Of course, a lot of the stories are familiar.

SPECTRUM 3

Edited by Kingsley Amis & Robert Conquest • Berkley Books, New York • No. X1108 • 1965 • 254 pp. • 60¢

Third and best of these English editors' selections for the uninformed in SF. For the informed, the best stories may be too familiar.

PENELOPE

By William C. Anderson • Pocket Books, New York • No. 50126 • 1965 • 197 pp. • 50¢

The hilarious adventures of the U.S. Air Force and the sweet-talking lady porpoise. As close to Thorne Smith as you get nowadays—and meatier.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

brass tacks

Dear Mr. Campbell:

It occurred to me while reading your "The Nature of Literature" that the reason so few professionally trained Litterateurs become successful authors is simple—they have nothing to say about anything except Literature. They are concerned by inclination and training with *how* something is said rather than what is said, with the means rather than the end of writing. Language is a tool specifically designed—by a process not so very different from evolution in biology—to communicate ideas—not words—between minds and, as such, presupposes ideas to be communicated. Without ideas the whole business of literature and language is utterly pointless. Where scientists, engineers, lawyers, even soldiers and businessmen are trained either scholastically or professionally to deal with certain ideas and ideals and use language to express them, litterateurs study ideas about the language itself and not the ideas which make language useful.

This is not necessarily bad. Mathematicians do the same sort of thing for more practical minded people such as scientists and engineers. Of course mathematicians have developed mathematics far beyond the needs of today's scientists, but the first purpose of mathematics remains that of communicating ideas about the real world. I might add that a good many mathematicians will not even speak of the practical uses of their art, preferring "pure" mathematics very much as the litterateurs prefer "Literature."

One unfortunate side effect of this situation is that those who study language—literature or mathematics—for its own sake and without constant reference to its purpose are quite often impractical-minded and end up teaching (!) not only people of like mind but also those who are trying to become scientists and engineers, doctors and lawyers, soldiers and politicians, and others who must deal with the real world. It is not surprising that mathematics and English are almost universally despised courses among undergraduates.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Neither is it surprising that many—too many—engineers, scientists, and so on are notoriously poor mathematicians and writers.

It is interesting to note that the greatest of our scientists and our other thinkers are expert communicators. Mathematics and literary devices are often *invented* by such men in order to communicate new ideas.

Your editorials are always good, often outstanding, and always the first thing I read each month when I receive your excellent magazine. I have missed many of your editorials, particularly those written more than three years ago, and am wondering if there is any possibility of your collecting some of the more lasting and general essays into book form? I'm sure you have more than enough fans willing to buy such a book to make it commercially successful even if it is sold only to readers of Analog.

RICHARD G. AYERS

2206 E. Main
League City, Texas

Doubleday is bringing out a collection of my editorials next spring—edited by Harry Harrison.

Dear Mr. Campbell:

The FASEG problem has been studied at some length by the Military Research units as well, and we have successfully reproduced the phenomena recorded in the original experiment with a carriage lattice. However, we have run into some further difficulties with the M/F factor. Assuming that one Godmother is absorbed in the metamorphosis from pumpkin to carriage, and only one Godmother is present in the environment, how does one account for the mutation of four horses from mice, and two footmen from frogs?

We attempted to modify the experiment by the use of a lattice of footmen—who objected violently—and another of horses, but with no observed emission of Godmothers.

We believe that the M/F (Mouse/Frog) factor could be the clue to a sub-particle of Fairy Godmother, which we have dubbed the *FAGO*TRON.

We have carefully examined our Goodness, Altruism, and Pity-charged plates, which should tend to attract the *FAGO*TRON particles, and have been successful in achieving perfect negative results, which prove the existence of the particles by all contemporary standards.

Our work is continuing under security wraps which preclude further discussion of plans concerning bats and brooms, et cetera.

ROBERT T. GARROW

An extension of the original theory of FASEG of at least equal validity and ingenuity!

Dear Mr. Campbell:

The scales of a bird's toes are bet-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ter insulators than would be thicker layers of lagging. A simple calculation will show that, because the heat flow from a circular sectioned rod is radial, there is an optimal thickness of insulation. This thickness depends solely on the ratio of conduction and convection coefficients. For greater or less thicknesses the heat loss rate will be greater. Indeed, however good an insulator the lagging may be, if you put too much on, the rod will lose heat faster than if it had no lagging at all.

In my youth, over forty years ago, Professor A. W. Porter used to demonstrate this effect to students at University College, London, England, with a wire encased for part of its length in a fused quartz tube whose exterior radius was five to ten times that of the wire. He then turned out the lecture room lights ("Alf" was no coward) and passed a current through the wire. The unlagged part glowed brightly, that lagged with quartz was dark, showing that it was losing heat more rapidly than the bare wire.

The lesson to be drawn from this, according to Professor Porter, was that if daddy longlegs wore silk stockings in winter, they would suffer from frostbite.

In short, it is because birds' toes and legs are so thin, that a very thin layer of scale is more effective than a thicker one.

R. A. FAIRTHORNE
1500 Massachusetts Avenue NW
Washington, D. C. 20005

Well, yes—but birds' toes aren't electrically heated, and aren't always in still air. How do they pump in enough heat to prevent freezing?

Dear Mr. Campbell:

May I, as an English scientist who occasionally reads, and always enjoys your magazine, say how much I was impressed with your editorial "Keeperism" in the July issue of Analog.

It has always seemed extraordinary to friends of America in this country that individual Americans should be so full of understanding and good will and yet that the United States' policy is so systematically based on the assumption that everyone, everywhere, would like to live exactly as Americans now do. I remember a remark by President Truman some years ago which was undoubtedly meant to represent the willingness of the United States to undertake real sacrifices for the common good. The exact words I do not remember, except for the "punch line," but they were roughly as follows: "We, in the United States, are willing to shoulder our responsibilities and do all that we can with our strength and our wealth to ensure that every person in the world should be able to live *as we think right.*" (My italics.)

To lovers of freedom of thought and action this statement was quite appalling. I have been to Russia and China and the U.S.A. and it is per-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

fectly clear to me that the majority of Russians and Chinese, broadly speaking, approve of their own governments, just as you do. They have never in history had freedom of speech and they are firmly convinced that the new freedom to have education and a rising standard of living is the real freedom and that ours is phony. I spent some time in trying to persuade them that although I could see some real gains which they had received through Communism they would need freedom to speak if they were to keep these. They all seemed to think that I was preaching anarchy and seemed completely unable to understand why you should *want* to criticize a government which had done a lot of good, as they believe theirs to have done.

I am quite convinced that in our countries, too, people cared about freedom to eat and work before they realized the need for freedom of speech and that we shall do much better to applaud the gains that the Communists have made in these ways and not to interfere if we are to have any influence towards liberalizing their depressingly rigid political machines.

J. H. FREMLIN, D.Sc.
Department of Physics,
University of Birmingham
Edgbaston, Birmingham 15, England

The real problem is that if one accepts responsibility for another man's welfare, he is forced to take some authority, too!

Dear John:

I hate to have a good yarn ruined by a false premise. A fair percentage of the time, a false premise is likely to slip by me, since I'm no chemist, not much of a physicist and a very indifferent student of a lot of other disciplines.

But "Second Seeded" happens to hook up with a discipline I know. And since a fair part of the yarn depends on the effort to "account for" extreme musical talent in a previously non-musical family, it sort of falls to bits when you look at it.

Sure, musical talent of a high order tends to come from families where there has been previous musical talent (which can be high, as in the Bach family, middling as in the Mozart family before Wolfgang, or pretty low as in the Beethoven family) but a tendency is all you get. You don't get the sort of absolute ironclad rule this yarn depends on.

For instance: Telemann (whose folks wanted him to be a nice respectable lawyer, and whose musical talent seems to have come from nowhere at all, though it made him one of the most prolific and facile composers of his era, and one whose stock is steadily rising again these days); Moussorgsky (who never did learn the rules, for which God be praised, since the fact that he was able to write down simply what

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

he thought gave us "Boris Goudonov" and "Pictures at an Exhibition," among other things); Gershwin (who was still learning when he died, but who, as "Porgy" and the "Concerto" show, was on his way to being a composer not only of great popularity but of imposing merit) . . . and this can go on all night.

For that matter, the reverse sometimes happens. I have always thought of Johann Christian Bach as a poor guy who was more or less pushed into the family business (composing, along with his father, J. S. Bach, and all the other little Bachs, from K. P. E. Bach on down) and who did a solid workmanlike job of turning out stuff for years without any great talent for, or liking for, the work.

There are very few "absolutes" in musical history, and the one FitzPatrick uses doesn't happen to be one. But there is one, and sort of an interesting one. I've never seen this dealt with, or any explanation of it offered at all, but it might be worth mulling over.

Like this: there is no field of endeavor in which a woman has not made a name for herself—if the field is *physically* available to a woman (there are anatomical reasons why you are probably not going to see a great female baseball player, football player, et cetera) —except one. That one is the field of musical composition.

There are famous women all over the arts—Jane Austen and the Brontes, a whole slew of painters and even sculptors, et cetera. There are even great musicians who happen to have been women: Landowska, Dame Myra Hess and the great organist Jeanne Desmessieux come instantly to mind—all keyboard people because I happen to be a pianist, harpsichordist and occasional organist myself. I have no doubt I could sit here and think of women who were and are fine brass players, string players, wind players, et cetera.

But women composers? Offhand, in the entire history of music, I can come up with exactly three. One was a minor relative of Franz Liszt's: I have not heard her music performed and have never met anyone who has. There does not seem to be much of it and, judging by its present availability (a pretty good way to judge, now that LPs, having exhausted the major repertoire, are at work on more and more unfamiliar stuff), it is probably not of high professional caliber. (Sure, sometimes it takes a while—but it's *been* a while. And even the long-time vacancy that preceded the current discovery of Charles Ives, who evidently stopped composing nearly fifty years ago, was always lit by a sort of "underground" movement of musicians who did know Ives' work and kept it alive, Henry Covell among others. And even a composer not terribly well-known, like Leroy Robertson, appears on a couple of LPs these

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

days; the LPs are, as I've said, searching far and wide for material to record.) The two others are show composers: Richard Rodgers' daughter, whose stuff seems light and pleasant enough but hardly top-rank, and a woman named Billie Holiday, who wrote a song called "God Bless The Child."

Billie, of course, brings in the whole area of jazz—in which a performer is, sometimes, both performer and creator. I mention Billie alone, and that one song alone, because it's the only one I know of that has lasted as a "standard" in the field. It has survived long enough to be a composition, not an improvisation.

Why are there no female composers?

If anybody has an answer, I'd be delighted to hear of it. Women can like music, and even understand it. (I figure the population that has ears, in this special sense, at about 3 in 100, and no perceptible difference between male and female statistics. If anything, 3 in 100 is high). Women can play music, and sometimes play it with startling and welcome skill and knowledge. Women can teach music, and sometimes teach it surpassingly well.

Why can't they compose it?

LAURENCE M. JANIFER

New York 10025

Actually, you can broaden that. Why are there so very few first- or second-line women in any Art?

Dear Mr. Campbell:

I am writing to provide some comments on the "Problem in Thermodynamics" which appeared in the November, 1965 issue of Analog. There are three points which seem to me to be of importance.

First, thermodynamics is specifically the macroscopic description of equilibrium phenomena. With respect to the birds and their feet, thermodynamics is only applicable if we can demonstrate that the transfer of heat across the scales—which, by the way, are rather effective insulators, for their thickness—attains equilibrium in a time which is comparable to the time the bird stays on the branch. To amplify somewhat, it is a reasonable assumption that heat transfer across the foot can be described by something similar to Newton's law of cooling, i.e. that the heat transfer is proportional to the temperature gradient. Thus, if the bird's foot was not much warmer than the branch, and the rate constant was rather small—and the heat capacity of the foot was considerable—the bird might be able to stay on the branch for some time without much loss of heat.

The second point is more closely related to what is going on inside the scales. Bird foot, like most living things, is mostly water, with some things dissolved in it. Water has a molar freezing point depression of c. 2°C. in bulk, and has also

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

a considerable heat of fusion. These two items are relevant with respect to the exact point at which freezing occurs, but perhaps are not too important at 2°F. On the other hand, most of the water in a bird's foot is decidedly not present in bulk, and in particular is in close proximity to non aqueous material—cell lipids, and non-polar regions of protein molecules. It is known that freezing of such diphasic systems is considerably slower than bulk solutions, and freezing points may show considerable depression.

The last point is related to the tolerance of the foot for freezing. It is known that there are substantially no rapidly metabolizing tissues in the foot, either nervous or muscular. The connective tissue elements of bone, tendon, and cutaneous connective tissue are well suited to survive under conditions of low oxygen tension, since that is the normal circumstance. Under conditions of cold decelerated metabolism, such survival character would be enhanced. With regard to the point brought up concerning the heat carrying capacity of the circulation to the foot, it is certainly true that the circulation is not adequate to supply heat from the body to warm the feet. But what is even more important is that the bird cannot afford to divert heat from the superbly insulated central core of the body to the relatively less well insulated limbs, since that would result in an increased net heat loss for the whole animal, which would have to be made up for by increased food consumption. Food is hard enough to come by in the winter in the first place.

I could have considered the above matters in much more gruesome quantitative detail, but, since very few studies have been made on titmice or chickadees in the first place, direct application might be difficult. The major point to keep in mind is that the birds were selected evolutionarily for their ability to survive in cold winters, and that a modification of metabolism to suit an evolutionary need is easier than its modification to suit a technological one.

In conclusion, I enjoy your Fortean attacks on the Ivory Towers of contemporary science, although I believe that most of them arise from an essential lack of technical comprehension, rather than the occurrence of any severe breaches in the bulwarks. But more power to you; you make us examine ourselves and our motivations more closely, and to reaffirm our understanding of the foundations of our work.

BARRY BUNOW
Harvard Medical School
Boston, Massachusetts 02115

You're suggesting it takes more than the twelve hours a bird spends perched at night for his little toes to come to equilibrium with −10° F temperature?

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

EDITORIAL

continued from page 7

Commercial airliners aren't normally equipped to talk to each other. And the air traffic over that northeast corridor from Boston to and around New York is fantastically dense for such high-speed planes.

How the planes managed to unscramble themselves, realign the traffic patterns without ground control, until the still-functioning airports, that were lucky enough to have commercial power, took over is a major feat of pilotage on the part of all the airliner captains in the air at the time.

If there had been drizzling clouds at the time . . .

It wasn't that Newark, Philadelphia, and the other airports that offered the planes refuge were better run; they just happened to be lucky enough to be in an area the Blackout didn't reach.

That all those airports could have been set up without any provision for emergency power represents a true Type III mistake. They rejected responsibility for maintenance of power supply on the basis that the commercial power companies "should" maintain it for them.

That type of mistake *does* merit the assignment of guilt, not merely responsibility. It was inexcusable.

Note that the military bases throughout the area simply switched to their local emergency power generators, and continued full normal operations. The Bell Telephone system hiccuped slightly while storage batteries took over the load, and then their emergency generators were started up and the telephone system operated normally. Military communications functioned perfectly, on fully competent emergency power plants. The search radars that keep constant watch over America's skies didn't falter, nor did the communications links feeding the data to command centers.

But the commercial airports, with literally thousands of human beings depending on them for life, all blacked out.

Sure—I know. The power companies are legally required to maintain power supplies to their customers.

Another group of Type III errors also showed up—the major hospitals throughout the blackout area were, almost at once, busily screaming for help from police and other agencies for emergency-power generators. The police, like the military, had adequate emergency-power arrangements, and were able to carry on their work very competently, and did supply several hospitals with emergency-power generators. Commercial companies that sell such equipment also

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

acted quickly to loan units they had in stock. And they had to loan some *big* units; any hospital which needed a one thousand kilowatt emergency generator rushed to the street beside the building was obviously badly in need of power.

There were babies being born by candlelight in great New York hospitals. A brain operation was completed by the light of a few flashlights. A frantic call came from one of the major hospitals for ice from a commercial ice manufacturer—ice to preserve the blood in their blood bank.

Oh, I tell you—New York's hospitals were in fine shape to handle any emergency that might come along.

New York City's Civil Defense system fell flat on its face, too.

The major radio stations of the city displayed ludicrous ineptitude in the emergency-preparations department—what a help they'd have been in a *real* emergency! Most of them stayed on the air . . . thanks solely to the fact that the transmitters were located in New Jersey, and the New Jersey power companies were not tied into the New England network. (The transmitters are across the river on the New Jersey meadows because (1) land is cheap there, and (2) the meadows are saltwater marshes, which gives the antennas an almost ideal ground to work against.)

But the studios of the major network stations were all in New York, of course. And they were able to communicate with their transmitters in New Jersey only because the telephone company, unlike the radio stations, did consider the problem of loss of commercial power, and had emergency equipment. The announcers in New York were operating by candlelight, flashlight, or —in one case—by the light of an automobile lamp hitched to an automobile storage battery someone had lugged up ten flights of stairs.

The airports were just plain, miraculously lucky that their failures didn't kill anybody. The hospitals were equally miraculously lucky. Sure . . . they finished a brain operation by flashlight. Fine—skilled surgeons are human beings, and human beings, as organisms, have several hundred million years of evolution under the basic proposition "Lethal emergencies are normal; learn how to adapt anyway."

But modern hospital equipment is electronically operated; the anesthetist uses electronic sensing devices to keep track of his patient's heart functions—pulse, blood pressure, regularity. There's usually a cardiac monitor device watching electronically along with the anesthetist, and ready to send electronic impulses immediately if the heart suddenly slows, or shows signs of fibrillation. Many modern operation procedures are predicted on the fact that such equipment gives the surgeons a reserve back-up, so that if the operation requires it, the nor-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

mal heart-stimulating nerves can be interfered with briefly.

Fortunately, at the moment of the blackout, nobody happened to be hitched to a heart-lung machine. If anyone had, he would, of course, be dead the moment the blackout hit.

That the hospitals were so helplessly dependent on commercial power lines is flatly inexcusable. Again—sure, the power companies are legally required to maintain service. Yeah . . . and maybe somebody should pass laws against earthquakes, tsunami waves, major hurricanes, and major meteor strikes. Or even some disgruntled paranoid with a suitcase full of dynamite in the nearest power substation. It doesn't require that the whole northeast be blacked out to interrupt the power to a hospital.

In the event of a major disaster, it's obvious that the hospitals would be most desperately needed.

And the Great Blackout demonstrated that the hospitals, under those conditions, would be plaintively bleating for somebody to supply them with emergency power.

It's inexcusable, because emergency power equipment isn't that darned expensive that they can't afford it. Flashlights are marvelous gadgets—but let's see you take X rays of a fractured skull with flashlights. Or keep baby incubators warm and the oxygen flow regulated with flashlight batteries.

I have a 3.5 kilowatt gasoline-powered generator in my garage. I bought it as insurance for my home in case of a power failure; it's been there for fourteen years and hasn't been run for anything but routine testing—but it was cheaper than insurance on the food in our freezer would have been. And it assured light, oil-fired heat, and some electric stove power, as well as freezer and refrigerator maintenance.

I checked our local hospital; they have a 35-kva generator system with an automatic relay cut-over that starts immediately if the power line fails. This supplies all the operating rooms, and the emergency ward. An additional 100-kva unit cuts in manually, as soon as the plant engineer reaches it. The two can handle the entire normal power load of the hospital.

But New York's great hospitals weren't ready.

Wonder if your local hospital would be prepared if the power failed? Or, when a disaster made it most needed, would it be crying for someone else to supply them with what they know they'll need in any major emergency?

Or does your area have a special dispensation from God guaranteeing that no disaster through which no power transmission system could survive will strike?

The question of "what" caused the Blackout seems to be settled; a "sensing relay," part of the protective system of the great Sir Adam Beck hydroelectric power plant

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

near Niagara Falls, in Canada, was the immediate cause. It's essential to understanding the Blackout problem to know something of the characteristics of modern power plant machinery—particularly you need to know how extremely sensitive to overload the huge generators actually are.

A modern gigawatt generator, if short-circuited, can destroy itself within *ten cycles*—one sixth of a second.

That very simply explains why you can't leave the protection of the generating equipment to human engineers' reactions. Overload relays, to be of any value as protective devices, must react in appreciably less than that sixth of a second. Old and now obsolescent relays react in six cycles; modern gear can open the circuit within three cyles.

And that means a switch-gear massive enough to handle the short-circuit currents put out by a gigawatt generator—not merely the normal billion watts power, but the ruinous-overload level of power from the massive machine, with some thirty tons of metal whirling thirty-six hundred times a minute.

It's done with "solid-state devices" all right—solid masses of copper, magnetic iron, and steel. You don't use *semi*-conductors when you're working with currents of that magnitude.

But equipment that massive is not, itself, very sensitive to critically important changes; therefore, the massive heavy-duty switch-gear is operated by a smaller "sensing relay" which can be adjusted to the desired level of sensitivity and which—because it is relatively small and light—can react very swiftly. The sensing relay then slams a triggering current into the heavy switch-gear's operating coils, the whole sequence from first sensing to final opening of the line taking less than three cycles of the sixty-cycle current.

It was one of the sensing relays at the Sir Adam Beck that first kicked out, throwing its associated big switch-gear open. One of the lines carrying the Sir Adam Beck's power to the Ontario area loads opened. The four remaining power lines were, then, overloaded, since the peak load demand of an early winter evening was on the system at the time.

Naturally, the now-overloaded lines were kicked off by their associated protective relay-switches.

The Big Trouble began happening at that point—for the Sir Adam Beck plant's huge power output now had no place to go but down the heavy-duty tie line feeding into the New England power grid. The Big Trouble for the power engineers of the world started at that point also. Because theoretically, that sudden diversion of power into the system shouldn't have caused any trouble that the regulating equipment couldn't handle. Normally, in a power tie-in, if one generator starts to

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

run a little bit faster than the dozens of others on that line—if it starts to get a little ahead of the others—the electromagnetic forces operating in the various generators tend to make the other generators stop generating, and start acting like motors. Remember that any generator is a motor, and any motor is a generator; it's the generator effect of back-EMF (back ElectroMotive Force) that limits the current flow into an operating motor. If the other generators start tending to motor instead of generate, the too-fast generator suddenly finds itself trying to drive the whole system, and carry all the load. This tends to dampen its over-enthusiasm quite promptly; it slows down.

Equally, a lagging generator tends to be driven by all the other generators, and forced up to proper speed.

The trouble with this theory is that it doesn't adequately take into account some five hundred miles of power lines, plus the fact that it takes time, even at the speed of light, to go five hundred miles and get back again. And the high interconnectivity of the power-grid network caused a wild sort of system of electrical surges to go ramming up and down and back and forth. Since there were *n* different paths through the multitude of interconnecting lines between any two selected power plants—no two paths being the same length, or having the same time-delay characteristics—the result seems to have been instant chaos.

One important problem—one that Professor Paynter of M.I.T. pointed out some years ago—has to do with the shutdown characteristics of power plants. Because of the immense mass and momentum of the water in the intake ducts of a hydroelectric plant, when the induction valves are suddenly closed down, for a brief time the hydro plant puts out more, not less, power. When a big modern steam plant is suddenly shut down, it behaves quite differently. The usual setup in a steam plant involves steam flow from main high-pressure, high-temperature boilers, through induction valves to the topping turbine, then to a reheater, then to the main turbines. Close down the induction valve, and the topping turbine is fairly quickly deprived of power. But not until the steam on its way through the reheater has been exhausted does the main turbine lose power. The interactions of hydro and steam plants on a tie line remain an unknown quantity, simply because the best theoretical analyses by different, and equally competent experts, disagree.

And therein is another reason why computer simulation analysis of the power network was impossible. The best experts at General Electric—which knows something about the business—and at M.I.T. are in disagreement as to what the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

proper equations are, and have been for a decade or more. And a mathematical simulation is, of course, always somewhat less reliable than the equations it's based on.

So far as mathematical logic is concerned, it's as far beyond our present techniques as a dynamic analysis of the motions of all the stars within four hundred light-years of Sol. The computers are just about able to solve, by successive approximation, the behavior of the ten major bodies of the Solar System for a reasonable time in the future.

The power network reacts in a time scale several billion times faster than the Solar System, and has several hundred force-generating components, instead of only ten gravitating bodies.

That's why the Great Blackout itself is a Type I mistake—the result of unavoidable ignorance. There was no way to analyze beforehand how the system would behave.

The unfortunate fact is that, moreover, we *still* can't analyze it. The only thing the Great Blackout has taught us, basically, is that that interactive breakdown phenomenon is not as improbable as we were, previously, convinced it was. Because we can't solve the problem of the complex interactions, we can't determine what to do to prevent it in the future. Another Great Blackout remains perfectly possible—just as possible as the first. And, incidentally, by the nature of the problem, will become constantly more probable as the complexity of the problem increases—as the interconnected power system spreads wider and wider.

When you can't find a way to prevent a breakdown of something, the thing to do is to figure out a reliable, fast way of reestablishing it when it does break down. And *that* didn't exist as of November 9, 1965—it took up to twenty hours to get things going again. That is one area in which the power engineers can act with knowledge and understanding; arranging better restart methods isn't in the realm of the utterly unanalyzable. However, until the Great Blackout demonstrated a realistic need for such arrangements, they appeared, to all sane power engineers, unnecessary, and expensive frills—economically unjustifiable. Like carrying built-in lifeboats on interurban buses because there *might* be a flood requiring lifeboats to reach safety.

The power company's start-up problem comes in two pieces: in-plant power-supply, and picking up the load again.

As stated above, the protective switch-gear operates in small slices of a fractional second; it has to. Imagine New York City's position if the switches hadn't opened, and Con Edison's great generators had been ruined. Gigawatt generating plants aren't something you pick up off the shelf from your nearest electrical supply store. They aren't

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

made to order in a few days, either. It takes months, even if the most extreme hurry-up overtime methods are used. And what would New York City have done during six months without electric power? The quantity of power involved simply couldn't have been made up by other plants in the northeast. For one thing, the forced evacuation of several million New Yorkers would have imposed great abnormal loads on all those other northeastern plants.

The slow dimming of lights in the area—the lights flickering and waning over many seconds of time, as they did—seems to show that the generators didn't cut off the line suddenly. I'm told, however, that this appearance was caused by what might properly be called "putting down the load." As stated above, every generator is a motor, and every motor is a generator. When the generators were yanked off the lines millions of electric motors, all up and down that line, were spinning. Some were huge multi-thousand-horsepower units and some were tiny electric clock motors, but in their myriads, they'd been absorbing a major part of the output of all those generating plants. Some were driving electric trains; some spinning heavy machinery in factories, some were massive "synchronous condensers" idling on the lines to keep the line power-factor under control.

When the generators quit, all the stored momentum and kinetic energy of those motors started feeding back into the power lines. The slow dimming of the lights represented the slow braking to rest of all the motors on the lines.

Part of the problem the power company engineers faced when they did get their plants running again was that they had to pick up all that dropped load—they had to get all those motors spinning again.

Their most immediate problem, however, was that they didn't have any in-plant power to get started with. Picture mentally the engineer on the control desk at Con Edison's great Energy Control Center in New York City. Before him is the console, studded with dials, switches, push-buttons and scores of remote-reading instruments. From that console he controls the opening and closing of the great steam valves—speeds or slows the automatic stoker mechanisms feeding the massive boilers—adjusts the excitation to the generators—operates the entire Con Ed system of power plants.

But just at the moment—say five minutes after the Blackout started—he's standing in helpless horror. He can't see his console, because there's no electric light. When somebody brings a battery-operated emergency light, he can see it—but the instruments are meaningless. Many of them are servo-operated remote-reading instruments; with

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the death of the power supply, there's no correlation between what the instrument reads, and what the situation is. The purely electrical instruments all read zero—zero volts at zero amps producing zero watts.

The valves regulating the flow of steam, boiler water, lube oil, and fuel to the system are electrically powered—and like modern automobiles, they don't have hand cranks for use in emergencies. If your modern car stalls, you get somebody else, whose car is operating, to push you to a speed that will start your engine, and get going that way.

That's the plan the power companies had; if something did force them off the line—if their generators did have to shut down completely, so they lost their own in-plant power—they had tie lines to two or more neighboring power plants that would supply them with needed in-plant and accessory start-up power. A neighbor could give them a push to get started again.

It didn't work this time, of course—because all the neighbors in New England were stalled simultaneously! The oil-fueled plants didn't have electric power enough to heat the oil which wouldn't flow—it's only slightly less viscous than road-tar when cold—to the oil pumps that couldn't pump without power. The coal-fired plants couldn't operate without power to operate the automatic stoker and ash-handling equipment. And they still needed electric power for valving and control systems, all designed to be fail-safe, and shut down things at once if the power to the control systems failed. (Without controls, how do you keep the boilers from exploding—or the turbines from running away, and bursting the equipment by sheer centrifugal force?)

The New York power system got started by reason of the fact that a small power plant on Long Island—the Rockland Power Company—had gotten off the tie lines quickly enough to save its in-plant power. The night engineer on duty when the blackout hit did what no computer system, for all its nanosecond speed of action, could have done. He broke the rules, threw away the

The only anthology of its kind — with many stories that cannot be found elsewhere

Future Perfect

American Science Fiction of the Nineteenth Century

By H. BRUCE FRANKLIN

"Mr. Franklin has strung the stories on a continuing thread of historical and critical comment that is highly illuminating. The book is an authentic find, a worthwhile addition to the libraries of all science fiction aficionados."
— GROFF CONKLIN

At all bookstores • $6.50
Oxford University Press

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

instructions, disobeyed orders, and slapped open all the main switches on his board when he saw that all his meters were going far into danger zones—and the generators were whining down under some terrific overload. (The tie line to New York was trying to make Rockland's small plant power all the electrical equipment in New York City.)

As soon as he broke the tie line to New York, his generators recovered, voltage went back where it belonged. He found that the outage was on the New York tie. (He assumed, naturally, that the *line* was at fault, not guessing that the whole Con Ed system had collapsed, along with everything north into Canada, east into parts of Maine and New Hampshire, and west as far as Detroit.) So, since his own local-town lines were all right, he quickly restored the power to Rockland—an oasis of light in the great darkness!

It was the small Rockland power plant that, later, gave Con Ed the "push to start" they needed—the in-plant power to restart their own greater generating equipment.

Somewhat more amusing was the sequence that got the Boston area power plants running again. They, too, were in the spot of the no-hand-crank-and-all-the-neighbors-stalled-too.

M.I.T. being an engineering school, has a power plant of its own, partly because they need an electric power plant to train electrical engineers, partly because they need some special types of power to feed the many laboratories, and partly because laboratory scientists doing experimental work frequently need huge amounts of power for short, irregular and unpredictable times. That sort of load is something a commercial plant can't tolerate; it louses up the voltage regulation for every other customer, and produces violent and destructive surges in their equipment.

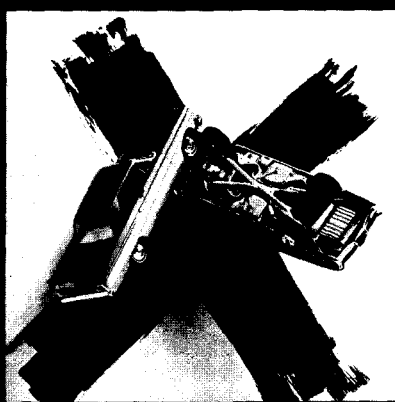
So, when the Cambridge Power Company found what the situation was, they hopefully called M.I.T. Did M.I.T. have its plant in operation? Unfortunately, no. It'd been closed down for the day. Could they get it started up? Well . . . they did have steam, by diverting steam from the dormitories and buildings for a while . . . but they didn't have start-up power either. However . . . hm-m-m . . . look, we'll call you back.

And presently, triumphantly, the M.I.T. plant fed start-up power to Cambridge, Cambridge could then feed start-up power to Boston Edison, which fed it down the tie lines to the rest of New England.

M.I.T.'s plant, being an engineering laboratory plant, and equipped with various types of laboratory-supply generators, had found a solution. But it must have been a somewhat odd sight to see the crew out lugging all those automobile storage batteries in to crank up a power plant!

The Editor.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



One of them was in the right.

So what.

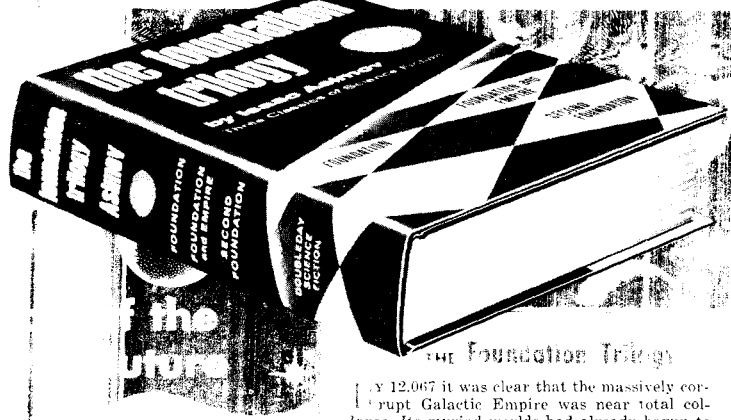
Nearly half the drivers in fatal accidents are in the right. But being in the right isn't enough. You've got to

Watch out for the other guy.

Published to save lives in cooperation with The Advertising Council and the National Safety Council

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

SPECIAL OFFER TO ANALOG READERS



THE Foundation Trilogy

—ORIGINALLY PUBLISHED IN THREE VOLUMES AT A COMBINED PRICE OF $10.50

FOR ONLY **10¢**

with a short trial membership in the Science Fiction Book Club

IN 12,067 it was clear that the massively corrupt Galactic Empire was near total collapse. Its myriad worlds had already begun to war among themselves, plunging the universe into barbaric chaos. Civilization seemed doomed.

But master scientists laboring to ensure that civilization would be preserved during the dark ages to come, established twin "Foundations" at opposite ends of the Galaxy, to form the *nucleus* of a new civilization, and in time to unite across the Galaxy to form a new . . . a stronger . . . a more enduring Second Empire.

In *Foundation* and *Foundation and Empire*, we follow the course of the First Foundation as it rekindles the light of civilization in an ever-increasing portion of the Galaxy – and as it is confronted by its greatest crisis: a dangerous mutant, *an evil yet brilliant psychopath whose soul-consuming desire is conquest of the Galaxy!*

Within a decade, he tyrannized the entire Galaxy – except for the *Second Foundation*. And this became his mania – to find and conquer the Second Foundation. *Everything in the Galaxy must be his!* . . .

THIS brilliantly exciting chronicle of the world of the future combines three great science fiction classics for the first time in one huge volume. *FOUNDATION . . . FOUNDATION and EMPIRE . . .* and *SECOND FOUNDATION* are among the most thought-provoking, compelling epics ever to come from the pen of the distinguished research biochemist and leading science fiction writer, Isaac Asimov.

Because you are an Analog reader, the Science Fiction Book Club would like to acquaint you with the most imaginative, informative, entertaining new science fiction books as they are written. That is why we have arranged to send you THE FOUNDATION TRILOGY for only 10¢ with a Trial Subscription to the Club.

Here's how the Club works: each month it offers a really superb new science *fact* or *fiction* book at a fraction of its regular price. Even though these books sell for $2.50, $3.00 and up in their original editions, Club members get them FOR ONLY $1 EACH – in special full-length, hard-cover editions. Extra-value books cost more. And the Club tells you in advance what each monthly selection will be. During your Trial Subscription you agree to take as few as four books in the next twelve months. After that you may take as few or as many books as you want, and you may cancel at any time. It's a deal that is hard to beat.

Mail Coupon With Only 10¢

THE FOUNDATION TRILOGY costs new members *only 10¢* with a short trial membership. After seven days, if you are NOT delighted, return the book and your membership will be canceled. Otherwise you will be enrolled in the Club as a Trial Member, and you need take only four books in the next twelve months. Mail the coupon *today* to: Science Fiction Book Club, Garden City, New York

SCIENCE FICTION BOOK CLUB
Dept. 63-AEX, Garden City, N. Y.

I enclose 10¢ to help cover shipping. Please rush me Isaac Asimov's FOUNDATION TRILOGY, and enroll me as a Trial Member in the Club. Then, every month send me the Club's free bulletin, "Things to Come," which describes coming selections. For each book I accept, I will pay only $1, plus shipping, unless I take an extra-value selection at a higher price. I need take only four books within a year and may resign at any time thereafter.

NO-RISK GUARANTEE. If not delighted with THE FOUNDATION TRILOGY, I may return it in 7 days, pay nothing, owe nothing, and my membership will be canceled.

Name .....

Address .....

City ..... Zone ..... State .....

If under 18, parent must sign here .....

(Offer good in U.S.A. only.) **10-571**

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED